

Comprehensive Underground Injection Control Program Evaluation:  
Missouri Department of Natural Resources  
Appendix

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## **A. MDNR Rules and Regulations**

### **Division 23 – Well Installation**



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# **Rules of Department of Natural Resources**

## **Division 23—Well Installation**

### **Chapter 1—Definitions, Variances, and Permitting Requirements**

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## Title 10—DEPARTMENT OF NATURAL RESOURCES

### Division 23—Well Installation Chapter 1—Definitions, Variances, and Permitting Requirements

#### 10 CSR 23-1.010 Definitions

**PURPOSE:** *This rule defines terms used in 10 CSR 23 that are not defined in section 256.603, RSMo.*

(1) Terms beginning with the letter A.

(A) Act means Missouri Water Well Drillers' Act, sections 256.600–256.640, RSMo, under which these rules are promulgated.

(B) Action level means the maximum permissible concentration of a contaminant in water pursuant to 10 CSR 60-2. Action levels are used for contaminants that do not have established maximum contaminant levels.

(C) Alluvium means clay, silt, sand, gravel, or similar unconsolidated material deposited by a stream or body of running water.

(D) Annular space means the space between two (2) cylindrical objects one (1) of which surrounds the other, such as the space between a borehole and a casing pipe or between a casing pipe and liner pipe.

(E) Applicant means any person who applies for a well, heat pump, monitoring well, or pump installation contractor permit pursuant to the law.

(F) Apprentice means any person who has been issued an apprentice permit who, under the supervision of a permitted nonrestricted well or pump installation contractor, is obtaining the knowledge, skills, and abilities necessary to apply for a non-restricted permit.

(G) Approval date means the date the record is reviewed and approved compliant with the construction requirements, not to be confused with certification or registration date.

(H) Aquifer means water-bearing geologic material that transmits water in sufficient quantities to supply a well.

(I) Augered well means a well that is drilled by the rotation of a cylindrical tool.

(2) Terms beginning with the letter B.

(A) Bedrock means a general term for the solid rock that underlies soil or other unconsolidated surficial material.

(B) Bentonite means any type of sodium bentonitic clay used in well construction, or plugging of wells, which swells or expands when water is added.

(C) Bentonite slurry means a mixture of sodium bentonite and water that has a solids content of at least twenty percent (20%).

(3) Terms beginning with the letter C.

(A) Casing means an impervious durable pipe placed in a well to prevent the borehole from collapsing and to prevent contaminants from entering the well.

(B) Cement slurry means mixture of cement and water that consists of one (1) ninety-four pound (94 lb.) bag of portland cement to six (6) gallons of water. Up to six percent (6%) bentonite may be used as an additive.

(C) Certification number means a number assigned to a record certifying compliance with 10 CSR 23 and sections 256.600–256.640, RSMo.

(D) Charitable or Benevolent Organization Water System means a public water system that exclusively serves a charitable or benevolent organization pursuant to section 640.116, RSMo.

(E) Chlorination means the use of chlorine to disinfect or sterilize wells, pumps, storage tanks, or piping systems.

(F) Clean fill means uncontaminated inert solid material such as pea gravel, sand, drill cuttings, and agricultural lime.

(G) Completion date means the date the work, subject to these rules, is complete as follows:

1. For installation of water wells, the date the well has casing set and grouted and the well is drilled to total depth;

2. For pump installation, the date the pump is set and pump or service truck leaves the site;

3. For installation of heat pump systems, the date the last well in the well field has been drilled and grouted;

4. For installation of monitoring wells, the date when the well has the riser, screen, and surface completion installed;

5. For plugging of temporary monitoring wells, the date the first well is plugged; or

6. For plugging of water, monitoring, heat pump, and test hole wells, the date the well is plugged.

(H) Construction foundation data means wells or borings drilled in the construction phase of piers, shafts, caissons, mini-piles, soil and rock anchors, soil and rock grouting procedures on surface water containment structures, pressure relief wells, roads, buildings, parking lots, or any drilling within the footprint of a proposed structure.

(I) Contaminant means any physical, chemical, biological, or radiological substance or matter in water that exceeds the maximum contaminant level or action level.

(J) Cuttings means geologic material displaced from the borehole during drilling.

(4) Terms beginning with the letter D.

(A) Demolition landfill has the same meaning as defined in section 260.200, RSMo.

(B) Department means the Missouri Department of Natural Resources, which includes the director thereof, or the person or division or program within the department delegated the authority to render the decision, order, determination, finding, or other action that is subject to review by the Administrative Hearing Commission.

(C) Director means the director of the Missouri Department of Natural Resources, or an authorized representative, who carries out the administrative functions of these rules on behalf of the department.

(D) Direct-push well means a monitoring well that is installed by pushing or hammering drive rods as opposed to drilling or augering. Direct-push wells tend to be smaller in diameter than their conventionally drilled counterparts leading to differences in annular space, casing, and sealing dimensions. Various screening or data collection devices, such as a cone penetrometer or lysimeter can be used in a direct-push well.

(E) Disinfection means the use of a chemical to sterilize wells, pumps, storage tanks, or piping systems.

(F) Domestic well means a private water supply well equipped with a pump that does not have the capacity to produce seventy (70) gallons or more of water per minute at the surface and that has three (3) or less service connections. A domestic well is not limited to residential usage.

(G) Drive shoe means the fittings placed at the bottom of the permanent metal casing which enables the driller to more efficiently drive the casing through the borehole and into solid rock.

(H) Dry hole means a well that was drilled and does not produce sufficient quantities of water for the intended use of the well.

(5) Terms beginning with the letter E.

(A) Extraction well means a monitoring well from which fluid or other media is extracted to clean, treat, or prevent contamination of groundwater as part of the remediation of a site. These include, but are not limited to, the following: wells serving pump and treat systems, including multi-well systems; wells to capture a contaminant plume or alter the direction or magnitude of groundwater movement; and other associated wells. Passive and active methane wells that terminate within landfill trash are exempted from these rules but are regulated by the Missouri Solid Waste Management Program. Passive and active methane and leachate extraction wells that are located outside of trash or





extend through trash into the underlying bedrock formations are regulated under these rules.

(6) Terms beginning with the letter (F). *(Reserved)*

(7) Terms beginning with the letter (G).

(A) Gas-migration well means a monitoring well that is designed for the sampling, detection, and analysis of a gas or a vapor that is potentially present or migrating away from a contaminant source.

(B) Geologic material means all earthen materials penetrated in drilling a well, such as alluvium, bedrock, glacial drift, residuum, and soil.

(C) Geotechnical well or boring means a monitoring well used to collect or evaluate subsurface data to determine the properties of geologic materials such as type, chemical composition, compressibility, strength, or structure. This does not include geotechnical borings for construction foundation data.

(D) Glacial drift (unconsolidated) means all rock material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by the ice or running water emanating from the glacier.

(E) Gravity grouting method means the process of pouring grout into the annular space or borehole without the use of a tremie pipe.

(F) Ground surface means the actual finished surface grade surrounding the well casing. This includes the natural ground surface, artificial fill, or hard surface such as concrete.

(G) Groundwater means any water beneath the surface of the ground.

(H) Grout means cement, bentonite, or other approved material used to seal the annular space or plug a well.

(8) Terms beginning with the letter H.

(A) Heat pump or geothermal well means any well constructed to use the heat exchange properties of either groundwater or geologic material penetrated in the well. Closed-loop horizontal heat pump systems installed in trenches or pits ten feet (10') or less in depth are exempt from these rules. Heat pump or geothermal systems that use surface water are exempt from these rules.

(B) High yield bedrock well means a water supply well drilled into bedrock aquifers that is equipped with a pump that has the capacity to produce seventy (70) or more gallons of water per minute to the surface and does not supply water to a public water system. These wells are also subject to major water user reporting requirements pursuant to sections

256.400–256.433, RSMo.

(C) High yield unconsolidated material well means a water supply well drilled into alluvial or glacial drift aquifers and is equipped with a pump that has the capacity to produce seventy (70) or more gallons of water per minute and does not supply water to a public water system. These wells are also subject to major water user reporting requirements pursuant to sections 256.400–256.433, RSMo.

(9) Terms beginning with the letter I.

(A) Impact Area means an area that contains contaminant(s) of one (1) or more of the following: lead, cadmium, chlorinated volatile organic compounds (VOCs) including trichloroethylene (TCE), TCE degradation products, or other contaminants pursuant to 10 CSR 60-4.

(B) Inactive well means a well not currently operational that is not in a state of disrepair and does not present a threat to groundwater.

(C) Incomplete well means a well that was abandoned during construction with or without casing and is susceptible to surface contamination.

(D) Injection well means a monitoring well into which fluid or other media is injected to clean, treat, or prevent contamination of groundwater.

(10) Terms beginning with the letter J. *(Reserved)*

(11) Terms beginning with the letter K. *(Reserved)*

(12) Terms beginning with the letter L.

(A) Liner means plastic or steel pipe which is smaller in diameter than the casing.

(13) Terms beginning with the letter M.

(A) Major reconstruction means the alteration or repair of any well that changes the original specifications such as depth of the well, liner installation, and/or replacing or extending the well casing above ground surface.

(B) Major water user has the same meaning as defined in section 256.400, RSMo.

(C) Maximum contaminant level means the maximum permissible concentration of a contaminant in drinking water pursuant to 10 CSR 60-2.

(D) Monitoring well means a well that is ten feet (10') or greater in depth and is constructed during assessment, characterization, and/or remediation of a site to obtain site-specific water quality, contaminant movement, or geologic or hydrologic data such as direct-push wells, extraction wells, gas-

migration wells, geotechnical wells or borings, injection wells, observation wells, piezometers, soil borings, and subsurface penetrations associated with field screening devices such as cone penetrometers and lysimeters.

(E) Multifamily well means a well that has no more than eight (8) connections, has a pumping capacity of less than seventy gallons per minute (<70 gpm), and serves fewer than twenty five (25) individuals on average. A multifamily well may be used to serve a charitable or benevolent organization pursuant to section 640.116, RSMo.

(14) Terms beginning with the letter N.

(A) Nested well means a cluster of two (2) or more single riser limited-interval monitoring wells installed at different depths in a single borehole with a grout seal separating each screened interval.

(B) Nominal diameter means the standard size for casing. Depending on the wall thickness, the inside diameter of the casing may be less than or greater than the number indicated.

(C) Nontransient noncommunity water system means a public water system as defined in 10 CSR 60-2.

(15) Terms beginning with the letter O.

(A) Observation well means any monitoring well in which the screen intersects a water table, for the specific purpose of determining either the elevation of the water table or the physical, chemical, biological, or radiological properties of groundwater. However, observation wells constructed in the tank pit and used as a part of an underground storage tank leak detection system are excluded from this definition.

(B) Open-hole completion means a monitoring well cased through all overburden material and upper water producing zones, completed in bedrock, with no well screen or filter pack.

(C) Open-hole grouting method means the process in which grout is introduced into the borehole by gravity or pumping through a tremie pipe before the casing is installed. The casing is lowered into the grout column to provide an annular seal.

(D) Open-loop heat pump water supply well means a well drilled to supply water for the purpose of heat transfer.

(E) Open-loop heat pump water return well means a well drilled to receive water from an open-loop heat pump water supply well that has passed through the heat pump machine.

(F) Ozark Confining Unit means low permeability bedrock that includes the Northview Formation, the Chattanooga Shale, and the



upper thirty feet (30') of the Cotter Dolomite that serves as a natural barrier to groundwater mixing between the upper and lower aquifer.

(16) Terms beginning with the letter P.

(A) Packer means a rubber or neoprene collar (boot) installed on the casing or liner to hold the grout material in the annular space.

(B) Permittee means a person who is permitted as a well, heat pump, monitoring well, or pump installation contractor pursuant to the provision of the law and these rules.

(C) Piezometer means a monitoring well used to measure the pressure of a fluid or the degree of compressibility of a substance when subjected to pressure or used to collect water samples for laboratory analysis. It is most commonly a small diameter well used to measure the hydraulic head of groundwater in subsurface water-bearing zones. Piezometers used to monitor the structural integrity of dams are exempt from the requirements of this rule.

(D) Pilot hole means a narrow hole drilled into the subsurface to facilitate the insertion of a larger drill bit or other boring tool and primarily used to site a location for a public well.

(E) Pitless adapter means a device for above or below ground discharge designed for attachment to one (1) or more openings through a well casing and constructed to prevent the entrance of contaminants into the well.

(F) Pitless unit means an assembly with a cap that extends from the upper end of the well casing to above ground surface and is constructed to prevent the entrance of contaminants into the well.

(G) Plastic means a thermoplastic pipe or casing material composed of either polyvinyl chloride (PVC) or acrylonitrile-butadiene-styrene (ABS).

(H) Point of entry means the point where the main water supply line—

1. Connects the well to the pressure system and includes the pressure switch inside the structure or building being served; or

2. Enters the structure or building being served if connection from the pressure switch is located outside the structure or building being served.

(I) Positive displacement grouting method means the process in which grout in slurry form is poured into the well casing, which is suspended above the bottom of the hole, followed by a drillable plug. The plug is pushed to the bottom of the casing, forcing the grout from the bottom of the casing into the annular space. The casing is then lowered into the bottom of the borehole.

(J) Potable water means water that is safe

for human consumption pursuant to 10 CSR 60.

(K) Pressure grouting method means the process in which grout is forced through the well casing followed by water so that the grout returns under pressure to the surface through the annular space. The grout is then allowed to cure following manufacturer's specifications before drilling resumes.

(L) Pressure tank or hydropneumatic tank means a closed water storage container constructed to operate under a designed pressure rating to modulate the water system pressure within a selected pressure range.

(M) Primary contractor means a person engaged for compensation in the business of the construction, alteration, major reconstruction, pump service, or plugging of any well or directs or supervises these activities. The primary contractor is equally responsible for the work performed by the installation contractor, including, but not limited to, the submittal of all forms and fees.

(N) Public water system has the same meaning as defined in section 640.102, RSMo.

(O) Public water supply well means a well that is constructed to supply water to a public water system.

(P) Public well pump means a pump that is installed in a public water supply well to provide water to a public water system.

(Q) Pump and pumping equipment means any equipment or materials used or intended for use in withdrawing or obtaining groundwater. This includes water distribution lines from the well and equipment from the well through the pressure system. This does not include buckets or bailers that are lowered into the well for the purpose of retrieving water in water wells. This also does not include sampling, development, maintenance, or testing equipment used or inserted into monitoring wells.

(R) Pump installation machine means any vehicle, hoist, or machine used to install or remove pumps or liners from wells.

(17) Terms beginning with the letter Q. *(Reserved)*

(18) Terms beginning with the letter R.

(A) Residuum means a product formed from the in-place disintegration and decomposition of bedrock.

(B) Reverse tremie grouting method means the process in which a tremie pipe is set to within twenty feet (20') of the bottom of the well bore; the lower ten feet to twenty feet (10' to 20') of tremie pipe is perforated; cement grout is poured from the surface, forcing water downward and into the tremie

pipe; and the water discharges to the surface. This method primarily is used for well plugging.

(C) Riser pipe means the pipe extending from the well screen into the surface completion of a monitoring well.

(19) Terms beginning with the letter S.

(A) Sanitary landfill has the same meaning as defined in section 260.200, RSMo.

(B) Screen means a filtering device used to keep sediment from entering a well.

(C) Septic tank means a watertight tank of durable materials through which wastewater flows.

(D) Service connection means a supply line from the well for the purpose of conveying water to a point of use that is connected to one (1) single family dwelling and includes additional water hookups for any outbuildings. If the outbuildings are dwellings for persons or additional businesses then they are considered additional service connections.

(E) Service vehicle means any rig, pump truck, or dedicated vehicle used to perform work that is regulated by 10 CSR 23.

(F) Sewer line means a pipe or conduit carrying wastewater to an ultimate point for treatment or discharge.

(G) Shallow monitoring means obtaining groundwater samples from a monitoring well within five feet (5') of ground surface.

(H) Site means a designated area on which a well or wells are drilled or are going to be drilled.

(I) Soil boring means a monitoring well used to sample or test the soil strata to determine soil properties such as type, chemical composition, compressibility, strength, structure, or concentration of contaminants.

(J) Solid waste disposal area has the same meaning as defined in section 260.200, RSMo.

(K) Special waste landfill has the same meaning as defined in Solid Waste Management Regulations 10 CSR 80-2.010.

(L) State of disrepair means a well that is unable to produce water to the ground surface or transport water to a point of use or poses a contamination risk to the groundwater. It does not mean a well that is waiting for pump installation or a well that has been approved by the department for temporary dormancy. See Inactive Well 10 CSR 23-1.010(9)(A).

(M) Static water level means the level of water measured from ground surface in a well that is not being affected by withdrawal of water.

(N) Subsurface disposal field, drainfield, percolation system, or tile absorption field means a system composed of open jointed tile, plastic lines, or lines composed of other



material buried in shallow trenches or beds through which sewage or wastewater is disposed.

(O) Suction line means a pipe or line connected to the inlet side of a pump or pumping equipment.

(P) Surface water means water that rests or flows on the surface of the ground.

(20) Terms beginning with the letter T.

(A) Temporary monitoring well means a monitoring well used for field screening purposes that is plugged within thirty (30) days of being installed.

(B) Test hole means a hole drilled for the exploration of minerals or for geologic data that is not associated with the remediation or associated environmental characterization of a site. This includes stratigraphic holes drilled to obtain geologic information for structural studies or seismic shot holes.

(C) Transient noncommunity water system means a public water system as defined in 10 CSR 60-2.

(D) Tremie pipe means a conductor pipe, hose, or tubing used in the down hole placement of grout.

(E) Tremie grouting method means the process in which a small diameter pipe is inserted in the annular space or borehole to the depth of the zone to be sealed and grout is emplaced through the tremie pipe by gravity.

(F) Tremie pressure grouting method means the process in which a small diameter pipe is inserted in the annular space or borehole to the depth of the zone to be sealed and grout is emplaced by pumping with a grout pump from the bottom to the top of the zone to be sealed.

(21) Terms beginning with the letter U.

(A) Unconsolidated material means sediment that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either at the surface or at depth, and does not include residuum.

(B) Utility waste landfill has the same meaning as defined in section 260.200, RSMo.

(22) Terms beginning with the letter V.

(A) Variance means a modification to any provision of 10 CSR 23 pursuant to 10 CSR 23-1.040.

(B) Vertical closed-loop heat pump well means the borehole perpendicular to the horizon deeper than ten feet (10') into which a closed-loop pipe is placed for the purpose of heat transfer.

(23) Terms beginning with the letter W.

(A) Wastewater means water or other liq-

uids that carry or contain pollutants or water contaminants from any source including sewage and gray water.

(B) Water Well Drillers Fund means Groundwater Protection Fund.

(C) Well certification means the assignment by the department of a certification number to the well after fulfillment of the requirements set forth in 10 CSR 23-2.020.

(D) Well drilling machine means any machine or device used for the construction or modification of a well and includes, but is not limited to, drill rigs and direct push machines. This excludes trenching machines in heat pump applications.

(E) Well registration means the assignment by the department of a registration number to the well after fulfillment of the requirements set forth in 10 CSR 23-2.020.

(F) Well seal means a device or method used to protect a well casing or water system from the entrance of any external pollutant at the point of entrance into the casing.

(G) Well vent means an outlet at the upper terminal of a well casing to allow equalization of air pressure in the well and escape of toxic or flammable gasses when present.

(24) Terms beginning with the letter X. *(Reserved)*

(25) Terms beginning with the letter Y.

(A) Yield or production means the quantity of water per unit of time which may flow or be pumped from a well under specified conditions.

(26) Terms beginning with the letter Z. *(Reserved)*

*AUTHORITY: sections 256.603 and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.603, RSMo 1985, amended 1991 and 256.626, RSMo 1985, amended 1991.*

#### 10 CSR 23-1.020 Application to All Wells (Rescinded August 30, 2018)

*AUTHORITY: sections 256.615, 256.620 and 256.626, RSMo Cum. Supp. 1991. Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16,*

*1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Rescinded: Filed Dec. 29, 2017, effective Aug. 30, 2018.*

#### 10 CSR 23-1.030 Types of Wells (Rescinded February 28, 2019)

*AUTHORITY: sections 256.606 and 256.626, RSMo 1994. Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.*

#### 10 CSR 23-1.040 Variances

*PURPOSE: This rule gives the timeframe and procedure for submitting a request for a variance to the department.*

(1) When strict applicability of any provision of these rules presents practical difficulties or unusual hardships, the department, in a specific instance, may modify the application of those provisions consistent with the general purpose of these rules and the law. The department may then impose certain conditions as are necessary to protect the groundwater of the state and health, safety, and general well-being of persons using or potential users of the groundwater supply.

(2) Requests for variances shall—

(A) Be submitted on a form provided by the department at least forty-eight (48) hours prior to any regulated work being performed, except as provided in 10 CSR 23-1.040(4);

(B) State the nature and reason the variance is being sought; and

(C) Include at a minimum the proposed well depth, desired yield, casing type and depth, method of construction and grouting, geologic conditions likely to be encountered, a GPS location of the well, and possible sources of contamination.

(3) The department will state the reason for the approval or denial and will notify the requestor of approval or denial of the variance. Construction or modification of the well may not begin without department approval of the variance.

(4) Verbal approval for a variance may be granted on a case-by-case basis for which



advanced notice could not be provided. The department will notify the requestor of approval or denial of the variance request.

(5) Approved variance requests will be provided with a number by the department that shall be included on the well certification or registration report form when it is submitted to the department.

*AUTHORITY: sections 256.606 and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

#### **10 CSR 23-1.050 Permittee Qualifications, Testing Procedures, and Permit Application**

*PURPOSE: This rule establishes criteria and application procedures for permitting water well, heat pump, monitoring well, and pump installation permittees.*

##### **(1) Restricted Permit.**

(A) To apply for a restricted permit as a water well, heat pump, monitoring well, or pump installation contractor an applicant shall—

1. Submit a complete permit testing application and corresponding fee;
2. Pass the applicable restricted permit test(s) (open book) with a minimum score of seventy percent (70%); and
3. Submit a complete permit application and the corresponding fee.

(B) After approval of the permit application, the department will issue the restricted permit. A permit may be denied if the applicant has unresolved violations.

(2) Non-Restricted Permit. See 10 CSR 23-1.050(7) for adding a permit type to an existing permit and 10 CSR 23-1.105 for reinstatement of an expired permit.

(A) To apply for a non-restricted permit as a water well, heat pump, monitoring well, or pump installation contractor an applicant shall—

1. Complete the apprenticeship program pursuant to 10 CSR 23-1.050(3);
2. Submit a complete permit testing application and corresponding fee;
3. Pass the applicable non-restricted permit test(s) (closed book) with a minimum score of seventy percent (70%);

4. Submit a complete permit application and the corresponding fee; and

5. If applicable pursuant to 10 CSR 23-1.050(3)(L) or 10 CSR 23-1.050(7) the apprenticeship program may be waived.

(B) After approval of the permit application, the department will issue the non-restricted permit. A permit application may be denied if the applicant has unresolved violations. After resolution of violations, the department may require prenotification pursuant to 10 CSR 23-1.050(6).

##### **(3) Apprenticeship Program.**

(A) To apply for a permit as an apprentice water well, heat pump, monitoring well, or pump installation contractor an applicant shall—

1. Submit a complete testing application and corresponding fee;
2. Pass the applicable apprentice permit test(s) (open book) with a minimum score of seventy percent (70%);
3. Submit a complete apprentice permit application, signed by a responsible party who will be responsible for the apprenticeship;
4. The responsible party shall be a non-restricted permit holder holding the same type of permit for which the apprentice is applying. A non-restricted permittee may not serve as an apprentice's responsible party for a period of one (1) year from the date of resolution of any enforcement action taken by the department (includes, but is not limited to, settlement agreements, orders, consent judgments, suspension, or revocation); and
5. After approval of the permit application, the department will issue the apprentice permit.

(B) The apprenticeship period is two (2) years.

(C) The applicant shall complete work for the applicable permit type and sign the appropriate certification or registration form on a minimum of—

1. Water Well Permit - Twenty-five (25) different domestic or multifamily water well installations or ten (10) different high yield bedrock or public wells;
2. Pump Installation Permit - Twenty-five (25) different domestic or multifamily pump installations or ten (10) different high yield or public well pump installations;
3. Heat Pump Installation Permit - Ten (10) different heat pump system installations;
4. Monitoring Well Permit - Twenty (20) different monitoring wells or twenty (20) different temporary monitoring well sites.

A. Test Hole Only Endorsement - Twenty (20) different test holes; and

5. Plugging abandoned wells for the applicable type of permit may count for up to ten percent (10%) of the required installations.

(D) The responsible party for the apprentice or another non-restricted permit holder for the applicable permit type shall oversee the apprentice's work on site, sign the certification or registration form as the installation contractor, and submit the form and appropriate fee.

(E) Once the number of installations pursuant to 10 CSR 23-1.050(3)(C) have been completed, the apprentice may work independently for the remainder of the two (2) year apprenticeship provided the responsible party continues to sign certification and registration forms as installation contractor along with the apprentice.

(F) The apprenticeship period may be reduced if the required number of installations pursuant to 10 CSR 23-1.050(3)(C) are met and proof of financial responsibility are provided for the remainder of the apprenticeship period pursuant to 10 CSR 23-1.050(5).

(G) An apprentice may transfer the apprenticeship to another company by submitting a new apprenticeship application to the department with a non-restricted permittee signing as the responsible party.

(H) An apprentice can be permitted under more than one (1) company if the apprentice submits the appropriate application and fee for each permit type and a non-restricted permittee from each company signs as the responsible party. Apprentices will be issued separate permit numbers for each permit type.

(I) At the end of the two (2) year period, the apprentice may apply to extend the apprenticeship on a year-by-year basis if the number of installations has not been met. If an application to extend the apprenticeship is not received, the apprentice permit will not be renewed.

(J) If an apprentice cancels the apprenticeship, they may reapply within five (5) years. If the application is approved, the apprentice will be reinstated at the same status as at the point of cancellation.

(K) Proof of work performed in other states by an apprentice will be evaluated on a case-by-case basis for meeting the requirements of 10 CSR 23-1.050(3)(C).

(L) Applicants who are permitted in another state may request an exemption to the apprenticeship program provided they—

1. Submit proof of a valid permit and supporting documentation that includes, at a minimum, a copy of current license or permit, examples of well records, and contact





information for the regulatory agency that issued the permit (same type of permit(s) only); and

2. Submit proof of financial responsibility pursuant to 10 CSR 23-1.050(5) for a period of two (2) years; and

3. Complete one (1) year of prenotification pursuant to 10 CSR 23-1.050(6).

(4) Testing.

(A) Applicants may retake the test one (1) time on the last test date. All subsequent test attempts shall be a minimum of thirty (30) days from the initial test date.

(B) An applicant may withdraw a testing application by notifying the department a minimum of ten (10) days in advance. Testing application fees are non-refundable; however, tests may be rescheduled up to two (2) times without cancellation of the application and forfeiture the corresponding fee.

(5) Financial Responsibility.

(A) Proof of financial responsibility pursuant to section 256.616, RSMo, when applicable, may be in the form of a surety bond, certificate of deposit (CD), or irrevocable letter of credit. The bond, CD, or letter of credit shall—

1. Be submitted to the department in the amount of twenty-five thousand dollars (\$25,000);

2. Be made payable to Missouri Department of Natural Resources;

3. Be issued by an institution authorized to issue such bonds in this state;

4. Be irrevocable letter of credit or automatically renewable (CD) for time frame covering the apprenticeship;

5. Have any interest on CDs made payable to the permittee; and

6. Be held for a period of two (2) years from the permit issue date.

(B) If the bond, CD, or letter of credit is cancelled by the issuing agent, the permittee shall submit new proof of financial responsibility within thirty (30) days of cancellation, or the permit will be suspended until proof of financial responsibility is restored.

(C) If the department finds that the contractor has outstanding administrative violations set forth in the Missouri Well Construction Rules, the department will notify the permittee that the bond, CD, or letter of credit will continue to be held as a condition of permit renewal for an additional two (2) years if the permittee does not resolve outstanding violations. Within thirty (30) days of notification of an outstanding administrative violation by the department the permittee is responsible for ensuring that the bond, CD, or letter of credit is valid for another two (2)

years or the permit will be subject to enforcement action, which may include suspension or revocation.

(6) Prenotification. Notice shall be given twenty four (24) hours in advance for any regulated work requiring prenotification. Prenotification shall include work to be performed, owner name, address, GPS location, and date work will begin. The prenotification requirement will be effective for one (1) year from the permit issue date unless otherwise directed by the department.

(7) Adding permit types.

(A) Current Missouri permit holders, with the exception of pump installation permit holders, may apply to add additional permit types by doing the following:

1. Complete apprenticeship program pursuant to 10 CSR 23-1.050(3) or submit proof of financial responsibility pursuant to 10 CSR 23-1.050(5) and complete one (1) year of prenotification pursuant to 10 CSR 23-1.050(6);

2. Submit a complete permit testing application and corresponding fee;

3. Pass the applicable restricted (open book) and nonrestricted (closed book) permit test(s) with minimum scores of seventy percent (70%); and

4. Submit a complete permit application and the corresponding fee.

(B) Any well installation permit holder may add a pump installation permit without completion of 10 CSR 23-1.050(5)(A).

(C) Pump installation permit holders shall complete the apprentice program to add additional permit types.

*AUTHORITY: sections 256.606, 256.607, 256.611, 256.613, and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed July 30, 2008, effective Feb. 28, 2009. Amended: Filed Sept. 15, 2011, effective April 30, 2012. Amended: Filed June 27, 2018, effective Feb. 28, 2019. \*\**

*\*Original authority: 256.606, RSMo 1991; 256.607, RSMo 1985, amended 1991; 256.611, RSMo 1985, amended 1991; 256.613, RSMo 1991; and 256.626, RSMo 1985, amended 1991.*

*\*\*Pursuant to Executive Orders 20 04 and 20 10, 10 CSR 23 1.050, paragraph (2)(A)3. was suspended from April 8, 2020 through June 15, 2020.*

**10 CSR 23-1.060 Application for a Permit**  
(Rescinded February 28, 2019)

*AUTHORITY: sections 256.606, 256.607, 256.611, 256.613, and 256.626, RSMo 2000. Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed July 30, 2008, effective Feb. 28, 2009. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.*

**10 CSR 23-1.070 Permit Review Procedures**  
(Rescinded March 10, 1994)

**10 CSR 23-1.075 Disciplinary Action**

*PURPOSE: This rule outlines the disciplinary action process.*

(1) The department may cause an investigation to be made upon receipt of information concerning alleged violations of sections 256.600 to 256.640, RSMo, and implementing regulations or any standard, limitation, or order pursuant thereto and may cause to be made any other investigations consistent with the purposes of sections 256.600 to 256.640, RSMo.

(2) If an investigation discloses that a violation of sections 256.600 to 256.640, RSMo, or implementing regulations exists, the department may issue an order requiring the remediation or abatement of the specified condition(s). The order will specify the violations of sections 256.600 to 256.640, RSMo, or implementing regulations or any standard, limitation, or order pursuant thereto or any term or condition violated.

(3) As a condition of any disciplinary action or order, the department will specify corrective actions and require that those actions be scheduled so that department staff can be present while the specified corrections are performed.

(4) A suspended permittee may be reinstated after the department approves that the terms and conditions, upon which the suspension order was based, have been corrected. The reinstated permittee may be placed on a period of probation as determined by the department.



(5) A permittee who has had a permit revoked may reapply for a permit pursuant to 10 CSR 23-1.050 as a new applicant and provide performance bond or irrevocable letter of credit pursuant to section 256.616, RSMo. The department will determine whether the person should be issued a new permit. In no case will a new permit be issued sooner than one (1) year after the revocation has taken effect.

*AUTHORITY:* sections 256.606, 256.623, 256.626, 256.630, and 621.250, RSMo 2016.\* *Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Sept. 14, 2006, effective March 30, 2007. Amended: Filed Jan. 11, 2013, effective Aug. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.623, RSMo 1985, amended 1991; 256.626, RSMo 1985, amended 1991; 256.630, RSMo 1985, amended 1991; and 621.250, RSMo 2005, amended 2008, 2011, 2012, 2013, 2015.*

#### **10 CSR 23-1.080 Denial of Application** (Rescinded February 28, 2019)

*AUTHORITY:* sections 256.606, 256.611 and 256.626, RSMo Cum. Supp. 1991. *Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.*

#### **10 CSR 23-1.090 Permits**

*PURPOSE:* This rule explains permit expectations to construct, repair, or plug a well.

##### **(1) General Permit Requirements.**

(A) A non-restricted permit is required to drill, construct, repair, reconstruct, plug, or install pumps or pumping equipment in a well.

(B) All non-restricted permits are valid for plugging wells, except monitoring wells. Monitoring wells shall be plugged by a monitoring well installation permittee.

(C) Restricted permits are required for persons who contract or sub-contract work regulated by Missouri Well Construction Rules.

(D) Restricted permits are required for persons to be a primary contractor and/or on-site drilling supervisor.

(E) All permits issued pursuant to these rules will expire one (1) year after issuance.

(F) Permit card(s) shall be carried by the

permittee and machine and vehicle cards shall be placed in each registered vehicle.

##### **(2) Permit Types.**

(A) A water well permit is valid for drilling, repairing, reconstructing, and plugging wells that produce water for human consumption, animal, industrial or irrigation purposes, and open-loop supply and return heat pump wells.

(B) A monitoring well permit is valid for drilling, coring, reconstructing, and plugging monitoring wells.

(C) A test hole endorsement is valid for drilling, coring, or plugging of wells in the explorations for minerals or for geologic data.

(D) A heat pump permit is valid for drilling, plugging, and repairing of heat pump wells (excluding open-loop heat pump and water return wells) and construction of trench systems and installation of loops used in heat pump systems.

(E) A pump permit is valid for installation and removal of pumps, liner installation, and for installation of pumps in extraction monitoring wells.

(3) Landowners may construct or plug a well on their own property pursuant to section 256.607(2), RSMo.

*AUTHORITY:* sections 256.606, 256.607, 256.613, 256.615, and 256.626, RSMo 2016.\* *Original rule filed April 2, 1987, effective July 27, 1987. Emergency rescission and emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Rescinded and readopted: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.607, RSMo 1985, amended 1991; 256.613, RSMo 1991; 256.615, RSMo 1991; and 256.626, RSMo 1985, amended 1991.*

#### **10 CSR 23-1.100 Permit Renewal** (Rescinded March 10, 1994)

#### **10 CSR 23-1.105 Permit Renewal**

*PURPOSE:* This rule outlines the procedure for renewing a permit.

(1) The permittee shall submit the appropriate renewal fee prior to the expiration date of the permit.

(2) Any permit renewal submitted after the expiration date will be assessed a late fee pursuant to 10 CSR 23-2.010(F).

(3) Reinstatement of an expired permit. An expired permit may be reinstated only for the permit type previously held.

(A) For reinstatement less than one (<1) year from expiration date.

1. Submit applicable permit application and fee.

(B) For reinstatement one or more ( $\geq 1$ ) year from expiration date.

1. Submit a complete testing application and corresponding fee.

2. Pass the applicable restricted permit test(s) (open book) and/or non-restricted permit test(s) (closed book) with a minimum score of seventy percent (70%).

3. Submit a complete permit application and corresponding fee.

4. Provide proof of completion of the required installations for the applicable permit type pursuant to 10 CSR 23-1.050(3)(C); or submit proof of financial responsibility pursuant to 10 CSR 23-1.050(5) and complete one (1) year of prenotification pursuant to 10 CSR 23-1.050(6).

(4) The permittee shall resolve any outstanding violations prior to permit reinstatement or renewal unless a schedule to remedy the violations has been approved in advance by the department.

(5) Any permittee who changes companies or wishes to cancel a permit shall notify the department.

*AUTHORITY:* sections 256.606, 256.607, 256.611, and 256.626, RSMo 2016.\* *Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.607, RSMo 1985, amended 1991; 256.611, RSMo 1985, amended 1991; and 256.626, RSMo 1985, amended 1991.*

#### **10 CSR 23-1.110 Permitting of Partnerships, Corporations and Business Associations** (Rescinded March 10, 1994)

#### **10 CSR 23-1.120 Suspension or Revocation of Permit** (Rescinded March 10, 1994)

**10 CSR 23-1.130 Reinstatement**  
(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.606, 256.616, 256.626 and 256.630, RSMo Cum. Supp. 1991. Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

**10 CSR 23-1.140 Vehicle and Machine Registration**

*PURPOSE:* This rule describes the registration process for drill rigs, direct push machine, pump installation trucks, and service vehicles.

(1) All well drilling and pump installation machines and service vehicles shall be registered with the department.

(2) To register vehicles and machines, a complete vehicle registration shall be submitted along with the appropriate fee pursuant to 10 CSR 23-2.010. A registration card will be issued for each vehicle and machine and shall be carried in each vehicle and machine at all times and be subject to inspection by the department. The card expires one (1) year from the date of issue.

(3) Notice of a change in ownership or the purchase of a vehicle and/or machine shall be provided to the department within thirty (30) days and submit a new application form and the appropriate fee. A new vehicle or machine card will be issued.

(4) A permittee shall place in a conspicuous location on both sides of each vehicle or machine the words MO PERMIT and the permit numbers not less than three inches (3") high and one and one-half inches (1 1/2") wide in a contrasting color to the background of the vehicle or machine. Permit number shall be placed on the vehicle or machine within sixty (60) days of receiving the vehicle or machine registration card.

*AUTHORITY:* sections 256.606, 256.617, and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.606, RSMo 1991; 256.617, RSMo 1985; and 256.626, RSMo 1985, amended 1991.

**10 CSR 23-1.150 Well Drilling and Pump Installation Machine Registration**  
(Rescinded March 10, 1994)**10 CSR 23-1.155 Well Drilling and Pump Installation Machine Registration**  
(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.606 and 256.626, RSMo Cum. Supp. 1991. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

**10 CSR 23-1.160 Mail and Notification Procedures**

*PURPOSE:* This rule informs permittees of notification procedures.

(1) Permittees shall notify the department of any change of business, residential, mailing, and electronic mailing addresses within thirty (30) days of change and accept all mail sent by the department.

(2) Regular and certified mail sent with proper postage to the last known address will be considered adequate notification of notice served.

(3) Refusal to accept mail is a violation of these rules and may result in disciplinary action.

*AUTHORITY:* section 256.600, RSMo 2016.\* Original rule filed April 18, 1990, effective June 28, 1990. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.600, RSMo 1985.



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**Rules of**  
**Department of Natural Resources**  
**Division 23—Well Installation**  
**Chapter 2—Fee Structure, Certification, and Registration**

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# **Title 10—DEPARTMENT OF NATURAL RESOURCES**

## **Division 23—Well Installation Chapter 2—Fee Structure, Certification, and Registration**

### **10 CSR 23-2.010 Fee Structure**

*PURPOSE: This rule establishes a fee structure for activities conducted under 10 CSR 23 pursuant to section 256.623, RSMo.*

(1) The following fees shall be assessed:

(A) Permits. A fee of no more than one hundred fifty dollars (\$150) for each type of contractor permit issued or renewed;

(B) Machine and Service Vehicle Permits. An annual fee of no more than fifty dollars (\$50) for each well drilling and pump installation machine and service vehicle;

(C) Certification Reports. A fee of no more than one hundred twenty-five dollars (\$125) per well paid by the well owner and collected and submitted by the well or pump installation contractor;

(D) Registration Reports. A fee of no more than one hundred dollars (\$100) per well paid by the well owner and collected and submitted by the well or pump installation contractor;

(E) Heat Pump Certification Reports. Fees will be paid by the owner and collected and submitted by the heat pump installation contractor. This fee will be determined by the ton rating of the heat pump unit. When more than one (1) heat pump unit is hooked together, the cumulative total of the ton rating will be used to determine the fee. The fee will be no more than—

1. One hundred fifty dollars (\$150) for a heat pump unit less than or equal to fifty (<50) tons; or

2. Two hundred fifty dollars (\$250) for a heat pump unit greater than fifty (> 50) tons;

(F) Late fees.

1. A late fee of no more than ten dollars (\$10) each month charged to the contractor until a complete certification or registration report has been submitted, not to exceed two hundred and forty dollars (\$240) per certification or registration report.

2. A late fee of no more than forty percent (40%) of the permit fee per year will be assessed when a well installation or pump installation contractor fails to renew a permit after the expiration date on the contractor's permit card;

(G) Well logging. Logging of well core or cuttings may be completed for a fee of no more than the actual costs involved in production of the log; and

(H) Test fees will be no more than the following:

1. General Test	\$50
2. Water Well Contractor Test	\$50
3. Pump Contractor Test	\$50
4. Heat Pump Contractor Test	\$50
5. Monitoring Well Contractor Test	\$50
6. Test Hole Contractor Test	\$50
7. Retakes (for each test)	\$50

*AUTHORITY: sections 256.606, 256.614, 256.623, and 256.626, RSMo 2016.\* Emergency rule filed July 2, 1986, effective July 12, 1986, expired Nov. 2, 1986. Original rule filed July 2, 1986, effective Oct. 27, 1986. Emergency amendment filed May 16, 1988, effective May 26, 1988, expired Sept. 22, 1988. Amended: Filed May 16, 1988, effective Aug. 26, 1988. Amended: Filed April 18, 1990, effective June 28, 1990. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Feb. 4, 1998, effective Aug. 30, 1998. Amended: Filed June 24, 2008, effective Jan. 30, 2009. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.614, RSMo 1985, amended 1991; 256.623, RSMo 1985, amended 1991; and 256.626, RSMo 1985, amended 1991.*

### **10 CSR 23-2.020 Certification and Registration**

*PURPOSE: This rule sets standards for certification and registration report submittal for water wells, monitoring wells, heat pump wells, test holes, and pump installations.*

(1) For certification and registration report requirements see section 256.614.1, RSMo.

(2) Certification of a well does not guarantee or imply that the well will produce potable or usable quantities of water.

(3) Certification reports.

(A) If the pump is installed within sixty (60) days of the well completion date, the pump information may be included on the well certification report.

(B) If the pump is installed more than sixty (60) days after the well completion date or if a different permitted contractor installs the pump, then the pump installation contractor is responsible for submitting a separate pump report.

(C) A certification report for a replacement pump installation is not required. However, reports may be submitted for replacement pump installations to meet pump installation contractor apprenticeship requirements.

(D) Pump replacement does not change the type or use of the well (i.e., from domestic to multifamily or from domestic to high yield).

(E) A certification report is not needed for temporary monitoring wells, dry holes, or test holes.

(4) Registration reports.

(A) Temporary monitoring wells located on the same monitoring site all may be reported on one (1) registration report with the associated fee, provided the wells are plugged in the same manner. The report shall be submitted within one hundred and eighty (180) days of the date of plugging the first temporary monitoring well.

(B) Test holes shall have registration reports submitted within one hundred and eighty (180) days of the date of completion of plugging and will be held confidentially for a minimum of ten (10) years pursuant to section 256.615.3, RSMo.

*AUTHORITY: sections 256.606, 256.614, 256.623, and 256.626, RSMo 2016.\* Original rule filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.614, RSMo 1985, amended 1991; 256.623, RSMo 1985, amended 1991; and 256.626, RSMo 1985, amended 1991.*



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# Rules of Department of Natural Resources

## Division 23—Well Installation

### Chapter 3—Water Well Construction Code

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**Title 10—DEPARTMENT OF  
NATURAL RESOURCES  
Division 23—Well Installation  
Chapter 3—Water Well Construction  
Code**

**10 CSR 23-3.010 Location of Wells**

*PURPOSE: This rule sets criteria for water well placement.*

(1) High yield unconsolidated well location requirements are found in 10 CSR 23-3.010(F). All other well types shall be—

(A) Located on a site that has sufficient surface drainage to prevent the accumulation or ponding of surface water within ten feet (10') of the well and, if possible, at a higher elevation than possible sources of contamination. The top of the casing shall extend a minimum of twelve inches (12") above ground surface;

(B) Located a minimum setback distance from potential Pollution or Contamination Sources. See 10 CSR 23-3.010 Table 3.1 for specific distances to be followed; and

(C) High yield unconsolidated wells shall be a minimum of two hundred feet (200') from contamination sources unless greater distances are specified in 10 CSR 23-3.010(1) Table 3.1.



Table 3.1 Specific setback distances for wells from pollution or contamination sources.

Feature requiring setback	Minimum horizontal distance
Storage area for commercial fertilizers or chemicals	300'
Demolition landfill	300'
Wastewater treatment plant or lagoon that serves commercial facilities, subdivisions, or mobile home parks	300'
Above ground or underground storage tank <sup>1,2</sup>	300'
Tank distribution lines for liquid petroleum, petroleum products, or chemicals <sup>1,2</sup>	300'
Earthen, concrete, or other manure storage structures or lagoons	300'
Land application areas for domestic or animal waste	300'
Animal composting facilities	300'
Unplugged abandoned wells	100'
Subsurface wastewater disposal field, grave, residential lagoon, privy, lift station, or pressurized sewer line	100'
Animal Feeding Operation (AFO) <sup>4</sup>	100'
An animal composting facility constructed with a concrete floor cell design covered with a roof	100'
Dry litter storage within a building	100'
Other areas with contaminants that may leach into the groundwater	100'
Septic tank or wastewater holding tank	50'
Pit or cistern	50'
Existing operating well	50'
Non-pressurized buried sewer line	25'
Solid waste disposal area, sanitary landfill, special waste landfill, utility waste landfill, waste stabilization pond (lagoon), or hazardous waste treatment, storage, or disposal facility <sup>3</sup>	1000'

1. Any well that cannot meet setback distances for petroleum distribution site shall meet the well construction requirements for a High Yield Bedrock well pursuant to 10 CSR 23-3.030(3).
2. Petroleum or petroleum products that are not liquid at standard temperatures and pressures are exempt from these setback requirements.
3. A safe distance cannot be determined. Any well that intercepts leachates from a waste landfill or waste stabilization pond (lagoon) shall be plugged unless it is approved by the department for use as a monitoring well.
4. Has the same meaning as defined in 10 CSR 20-6.300.



*AUTHORITY: sections 256.606 and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

#### **10 CSR 23-3.020 General Protection of Groundwater Quality and Resources**

*PURPOSE: This rule is for the overall protection of groundwater resources in Missouri.*

(1) Wells shall be constructed for their intended use in a manner that will protect groundwater resources and prevent contamination by surface and groundwater by ensuring the casing and wellhead completion are watertight and sealing off formations that are likely to pose a threat to groundwater.

(2) A person may not leave a well incomplete or a borehole open and shall plug or complete the well as directed by the department.

(3) A well previously used for storage or injection of gas, chemical, or any liquid shall not be converted to a well used for water supply.

(4) A person who converts a water well to an oil or gas well shall notify the department pursuant to section 256.614.2, RSMo.

(5) Maintenance and Repair of Wells.

(A) Wells shall be maintained by the owner in a condition where it will protect groundwater and not be a source of, or channel for, contamination or pollution to groundwater.

(B) All materials used in the construction, maintenance, or repair of any well shall meet the requirements in these rules.

(C) Broken, punctured, or damaged casing, or any part of the wellhead that is damaged or missing shall be repaired, replaced, or plugged pursuant to 10 CSR 23-3.110.

(D) Casing and/or drop pipe when being installed or replaced shall not come in direct contact with the ground surface.

(E) Major reconstruction of operational wells in existence on September 28, 1985 (pre-law wells) shall conform to minimum standards pursuant to 10 CSR 23-3. Major reconstruction of wells does not include pulling or setting a pump or plumbing alterations.

(6) Lubricants used during the drilling process shall not adversely affect the groundwater quality by entering the borehole.

(7) Water used in the drilling process or well development shall be of potable quality.

(8) Best management practices such as silt fences, straw bales, containment pits, or basins shall be used to contain drill cuttings, fluid, and foam resulting from drilling operations to minimize impact to land and prevent a discharge to waters of the state. If a discharge to a water of the state occurs, notify the department.

(9) Cross connections between wells and other systems or equipment containing water, chemicals, or substances of unknown risk to groundwater are prohibited, except when equipped with a suitable protective device such as a break tank or backflow prevention device. The owner shall test, retain all records of such tests, and maintain the backflow prevention device to ensure proper operation and protection of groundwater pursuant to 10 CSR 23-3.050(1)(C). Petroleum, fertilizer, and pesticide tanks will be allowed at the well site while irrigating and chemigating and be removed from the well site or emptied when not in use.

*AUTHORITY: sections 256.606, 256.614, 256.615, and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.614, RSMo 1985, amended 1991; 256.615, RSMo 1991; and 256.626, RSMo 1985, amended 1991.*

#### **10 CSR 23-3.025 Public Water Supply—Notification to Division** (Rescinded August 30, 2018)

*AUTHORITY: sections 256.606 and 256.628, RSMo Supp. 1991. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Rescinded: Filed Dec. 29, 2017, effective Aug. 30, 2018.*

#### **10 CSR 23-3.030 Standards for Construction of Water Wells**

*PURPOSE: This rule describes the minimum*

*construction standards for water wells.*

(1) Domestic Water Wells and Pilot Holes.

(A) Casing.

1. Steel well casing. The minimum standards for steel casing are found in Table 3.2.



Table 3.2 Minimum standards for steel casing.

Nominal Pipe (Inches)	Outside Diameter (Inches)	Wall Thickness	
		(Inches)	(Weight/Foot)
6	6 3/4	0.188	13
8	8 3/4	0.188	17
10	10 3/4	0.188	21
12	12 3/4	0.188	25
14	14	0.188	28
16	16	0.188	32

A. Joints. Joints shall be welded or threaded and be watertight. Recessed or reamed and drifted couplings shall be used on threaded casing. Other couplings may be used provided the design, taper, and type of thread of the coupling matches that of the pipe. Casing extension material shall be of similar material to the original casing. Other types of joints or devices used to join dissimilar casing extension materials may be used upon receiving prior written approval from the department.

B. Standards. Casing shall be new and meet American Society for Testing and Materials (ASTM), A53 grade A or B, A500 grade A or B, or A589 or other grade weldable new pipe having a quality equal to or greater than those specified. Used casing when salvaged within ninety (90) days of installation from a water supply well and is decontaminated is considered new pipe.

C. Drive shoe. In areas where steel casing is required, equip the well casing with a drive shoe or similar protective device to prevent damage to the well casing during construction of the well. If no drive shoe is used, follow the minimum grout cure times in Table 3.3.

Table 3.3 Minimum Cure Times for Grout

Grout Type	Minimum Cure Time (hours)
Hi early cement	12
Portland Type I cement	72
Chipped Bentonite	4
High Solids Bentonite Slurry	*

\*Follow manufacturer's guidelines. Cure time will vary based on additives.

2. Plastic well casing. The minimum standards for plastic well casing are found in Table 3.4.

Table 3.4 Minimum standards for plastic casing.

Nominal Pipe (Inches)	Outside Diameter (Inches)	Standard Dimension Ratio (SDR)	Schedule (SCH)
6	6 3/4	26	40

A. Joints. Well casing joints shall be watertight and joined by solvent weld (glued) or mechanical. Casing extension material shall be of similar material to the original casing. Other types of joints or devices used to join dissimilar casing extension materials may be used upon receiving prior written approval from the department.

B. Standards. Casing shall be: new and meet ASTM standards, composed of polyvinyl chloride (PVC) or acrylonitrile-butadiene-styrene (ABS) thermoplastics and meet ASTM standards, marked "Well Casing" and have the specification number F-480 Standard for Plastic Well Casing. Used casing when salvaged within ninety (90) days of installation from a water supply well and is decontaminated is considered new pipe.

C. Packers. A packer, coupling, or inverted bell shall be secured at the bottom of the casing and hold the grout in place while drilling continues. No packer, coupling, or inverted bell is needed if grout is allowed to cure following minimum cure times in Table 3.3.

3. Concrete and fiberglass well casing—

A. May be used for unconsolidated wells greater than eighteen inches (18") in diameter; and

B. Shall be composed of non-toxic durable material designed for use in potable water wells.

4. Other materials may be used upon receiving prior written approval from the department.

(B) Borehole. For borehole size see 10 CSR 23-3.090.

(C) Grouting. It is the responsibility of the well installation contractor to ensure that the annular space is sealed and that the casing does not leak. This responsibility ends three (3) years after the approval date by the department unless it can be proven that the annular seal has been damaged by other persons.

1. Grouting installation methods.

A. Gravity method.

(I) Bentonite granules or bentonite slurry shall not be poured through standing water greater than one hundred feet (> 100').

(II) Table 3.5 states the maximum depth that grout can be gravity fed into the well annulus.

(III) Gravity grouting greater than two hundred feet (200') in a four inch (4") annulus is not allowed.



Table 3.5 Maximum Gravity Grouting Depths

Borehole Size (inches)	Outside Diameter of Casing (inches)	Annular Space (inches)	Gravity Feed Depth (feet)
8 5/8	6 3/8	1	100
8 1/4	6 3/8	1 1/16	106
8 7/8	6 3/8	1 1/8	112
9	6 3/8	1 3/16	119
9 1/8	6 3/8	1 1/4	125
9 1/4	6 3/8	1 5/16	131
9 3/8	6 3/8	1 3/8	137
9 1/2	6 3/8	2 3/8	144
9 3/4	6 3/8	3	150
9 3/4	6 3/8	3 1/8	156
9 3/4	6 3/8	3 1/4	162
10	6 3/8	3 3/8	169
10 1/8	6 3/8	3 1/2	175
10 1/4	6 3/8	3 5/8	181
10 3/8	6 3/8	3 3/4	187
10 1/2	6 3/8	3 7/8	193
10 3/4	6 3/8	4	200

B. Tremie method. Tremie pipes shall be—

(I) Placed into the annulus and extend to no less than five feet (5') from the bottom of the interval to be grouted;

(II) Gradually withdrawn as the grouting material is emplaced; and

(III) No greater than ten feet (10') above the emplaced grouting material during the entire grouting process.

C. Tremie pressure method. The tremie pipe shall remain submerged in the grouting material during the entire grout pumping process.

D. Pressure method.

E. Open-hole method.

(I) Non-slurry bentonite may be poured from the surface and allowed to completely hydrate before the casing is installed.

(II) Bentonite slurry may be used in wells with more than one hundred feet (>100') of standing water only if the grout is emplaced by one (1) of the tremie grouting methods.

F. Positive displacement method.

(I) Bentonite slurry or cement slurry may be used in wells with more than one hundred feet (>100') of standing water only if the grout is emplaced by one (1) of the tremie grouting methods.

G. Other grouting methods may be used upon receiving prior written approval from the department.

2. Grout materials.

A. Cement slurry.

B. Bentonite slurry.

C. Bentonite non-slurry. If there is no water in the annular space, the bentonite shall be hydrated.

D. Other grout types may be used upon receiving prior written approval from

the department.

(D) Driving Casing.

1. When geologic conditions require the casing to be driven, the casing may be driven to the casing depth without adding grout.

2. Once the casing is set, install liner pursuant to 10 CSR 23-3.080.

3. In addition to the liner, a top annular casing seal, at least ten feet (10') deep is required below the pitless connection.

4. A liner and top annular seal are not required when the open hole method or positive displacement grouting method is used.

(E) Wellhead Completion. Follow well casing seal and connection installation pursuant to 10 CSR 23-3.050(6).

(2) Multifamily Wells.

(A) Multifamily wells shall have no more than eight (8) connections, fewer than twenty-five (25) individuals, and have a pumping capacity of less than seventy gallons per minute (<70 gpm).

(B) Multifamily wells may be used to serve a charitable or benevolent organization pursuant to section 640.116, RSMo.

(C) Casing.

1. Follow 10 CSR 23-3.090 for minimum casing depths by Drilling Area for domestic water wells.

2. Install new steel casing that meets the minimum standards specified in Table 3.2 for size and weight.

3. Other casing design or materials may be used upon receiving prior written approval from the department.

4. Liners are not a substitute for casing.

(D) Joints. Well casing joints shall be welded or threaded and be watertight. Other types of joints may be used upon receiving advanced written approval by the department.

Recessed or reamed and drifted couplings shall be used on threaded casing; other couplings may be used provided the design, taper, and type of thread matches that of the pipe.

(E) Standards. Pipe shall be new and meet the ASTM, A53 grade A or B, A500 grade A or B, or A589 or other grade weldable new pipe having a quality equal to or greater than those specified. Used pipe is considered new if it is salvaged within ninety (90) days of installation from a new water well.

(F) Drive shoe. Equip the well casing with a drive shoe or similar protective device to prevent damage to the well casing during construction of the well.

(G) Borehole. Construct the borehole a minimum of ten and five-eighths inches (10 5/8") in diameter to the casing depth. Larger casing may be installed provided the borehole is a minimum of four inches (4") larger in diameter.

(H) Grouting. Grout the annular space of the well full length. It is the responsibility of the well installation contractor to ensure that the annular space is sealed and that the casing does not leak. This responsibility ends three (3) years after the date of approval by the department unless it can be proven that the well seal has been damaged by another person.

1. Grouting installation methods.

A. Tremie method pursuant to 10 CSR 23-3.030(1)(C)1.B.

B. Tremie pressure method pursuant to 10 CSR 23-3.030(1)(C)1.C.

C. Pressure method pursuant to 10 CSR 23-3.030(1)(C)1.D.

2. Grout materials.

A. Grout types pursuant to 10 CSR 23-3.030(1)(C)2. may be used except powdered



or granular non-slurry bentonite.

B. Other grout types may be used upon receiving prior written approval from the department.

(I) Wellhead Completion. The wellhead shall be completed pursuant to 10 CSR 23-3.050(6).

(3) High yield bedrock wells or high yield unconsolidated wells two hundred feet (200') or more in depth.

(A) Casing.

1. The minimum amount of casing shall be determined by the department in advance.

2. Install new steel casing that meets the minimum standards specified in Table 3.6 for size and weight.

3. In lieu of steel casing, unconsolidated wells two hundred feet (200') or more in depth may use Schedule 80 or Standard Dimension Ratio 21 (SDR 21) plastic casing.

4. Liners are not a substitute for casing.

5. Other design or materials may be used upon receiving prior written approval from the department.

Table 3.6 Minimum steel casing requirements for high yield bedrock wells and high yield unconsolidated wells two hundred feet (200') or more in depth.

Nominal Pipe (inches)	Outside Diameter (inches)	Wall Thickness (inches)	Weight per foot (lbs.)
6	6 5/8	0.280	19
8	8 7/8	0.322	29
10	10 3/4	0.365	40
12	12 3/4	0.375	50
14	14	0.375	55
16	16	0.375	63
18	18	0.375	71
20	20	0.375	79
22	22	0.500	115
24	24	0.500	125
26	26	0.500	136
28	28	0.500	147
30	30	0.500	158
32	32	0.500	168
34	34	0.500	179
36	36	0.500	190

(B) Joints, Standards, Drive shoe, Borehole, Grouting, and Wellhead Completion shall be followed pursuant to 10 CSR 23-3.030(2)(D) to 10 CSR 23-3.030(2)(I).

(4) High yield unconsolidated wells less than two hundred feet (<200').

(A) High yield unconsolidated wells less than two hundred feet (<200') in depth.

1. Install a minimum of twenty feet (20') of casing.

2. Install new steel or plastic casing that meets the minimum standards specified in Table 3.2 or Table 3.4, respectively.

3. Other design or materials may be used upon receiving prior written approval from the department.

(B) Borehole. Construct the borehole pursuant to 10 CSR 23-3.030(2)(G).

(C) Grouting. Install a ten foot (10') minimum top grout seal. It is the responsibility of the well installation contractor to ensure that the annular space is sealed and that the casing does not leak. This responsibility ends three (3) years after the date of approval by the department unless it can be proven that the annular seal has been damaged by another person.

1. Grouting installation methods.

A. Gravity method pursuant to 10 CSR 23-3.030(1)(C)1.A.

B. Tremie method pursuant to 10 CSR 23-3.030(1)(C)1.B.

C. Tremie pressure method pursuant

to 10 CSR 23-3.030(1)(C)1.C.

D. Pressure method pursuant to 10 CSR 23-3.030(1)(C)1.D.

2. Grout materials.

A. Cement slurry.

B. Non-slurry bentonite.

C. Other grout types may be used upon receiving prior written approval from the department.

(D) Gravel Pack. All gravel placed into the well shall be clean, washed, and disinfected prior to placement or provisions made for disinfection in place.

(E) Wellhead Completion. Follow well casing seal and connection installation pursuant to 10 CSR 23-3.050(6).

(F) Major water users are subject to requirements pursuant to section 256.410, RSMo.

(5) Oil and gas zones.

(A) Report oil or gas encounters and the conversion of water wells to oil or gas wells pursuant to section 256.614, RSMo.

(B) Any water well that encounters oil and/or gas shall have an annular or open hole grout plug from fifty feet (50') below the oil and/or gas bearing zone to fifty feet (50') above the oil and/or gas bearing zone.

(C) The grout plug shall be composed of cement slurry with a two to six percent (2-6%) bentonite additive.

(D) The grout plug shall be placed via one (1) of the tremie methods.

*AUTHORITY: sections 256.606, 256.614, 256.615, and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.614, RSMo 1985, amended 1991; 256.615, RSMo 1991; and 256.626, RSMo 1985, amended 1991.*

## 10 CSR 23-3.040 Well Casing Seals and Connections

(Rescinded February 28, 2019)

*AUTHORITY: sections 256.606 and 256.626, RSMo Supp. 1991. Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.*





### 10 CSR 23-3.050 Pump Installation and Wellhead Completion

*PURPOSE: This rule sets specific standards as to the proper procedures for the installation of pumps, plumbing, and completion of the wellhead.*

#### (1) Pumps and Pumping Equipment.

(A) All wells shall have a pump installed that is either surface mounted or submersible.

(B) A pump shall be constructed so that no unprotected openings into the well casing exist. A hand pump, hand pump head, stand or similar device shall have a closed spout directed downward and a pump rod that operates through a stuffing box. A power driven pump shall be attached to the casing or approved suction or discharge line by a watertight connection.

#### (C) Backflow Prevention.

1. A backflow prevention device shall be installed on all wells where agricultural chemical injection or other pressurized contaminant sources are used.

2. A double check-spring loaded backflow prevention device shall be installed between the point of chemical injection and the water well in accordance with the manufacturer's instructions and shall have the following:

A. A valve so that water can be drained from the system to prevent freezing;

B. A vacuum relief valve to prevent back-siphoning of chemicals into the well;

C. An automatic low pressure drain at least three-quarters inch (3/4") in diameter that drains the check valve body of water when operation of the pump is discontinued;

D. A watertight seal around the check valve;

E. An inspection port at least four inches (4") in diameter to allow inspections of the inside of the check valve; and

F. A check valve able to withstand a minimum hydraulic pressure of one hundred fifty (150) pounds per square inch (psi) without leaking and resistant to corrosion.

3. The well pump and the chemical injection pump shall be electrically or mechanically connected so that when the well pump stops, the chemical pump will shut off automatically.

#### (D) Electrical.

1. A permitted pump installation contractor shall perform all electrical wiring that impacts the operation of the pump or pressure system to the point of entry. Any person may perform electrical wiring on high yield wells.

2. The electric wire shall not be installed through the pitless connection and shall be grounded.

(E) Plumbing. A permitted pump installation contractor, except as exempted in section 256.607.2, RSMo, shall perform all plumbing which impacts the distribution of water from its source, through the pressure system to the point of entry. This includes, but is not limited to, pressure tanks, water treatment equipment and any other materials needed to complete the initial installation of the water system, inside and outside of the structure.

(2) Water suction lines for surface pumps shall be constructed of galvanized iron, steel, plastic, or aluminum. Other materials may be used provided advanced written approval is obtained from the department. A well seal or equivalent shall be installed between the well casing and suction pipe that is watertight.

(3) Frost proof yard hydrants shall not be installed directly on the wellhead and be securely anchored.

#### (4) Pump Discharge Lines.

(A) A buried discharge line from the well to the pressure tank shall not be under negative pressure during normal operation.

(B) Pump discharge ports on high yield wells shall be covered when not in use.

(5) Drop pipe shall be rigid, of sufficient strength to support the weight and torque of the pump, be able to withstand the operating water pressure, be impact and abrasion resistant, and not impart contaminants into the groundwater.

#### (6) Wellhead Completion.

(A) Above-ground connections shall—

1. Be a minimum of twelve inches (12") above ground surface or well house floor;

2. Have watertight piping and electrical connections that are mechanical or welded and sealed;

3. Have a protective well cap that seals tightly against the casing and has a screened vent or a casing seal that has a new rubber gasket. Cutting the rubber well seal for installation is not allowed;

4. When used, have surface driven pumps extending at least one inch (1") into the base of the motor;

5. Be provided with a minimum of one-half inch (1/2") diameter screened vent pointed downward;

6. Not use hubcap type well caps for permanent use; and

7. Use temporary caps until a permanent cap or well seal is installed.

(B) Below-ground connections shall—

1. Use a pitless adaptor or pitless unit of sufficient strength to withstand normal oper-

ating stress;

2. Construct the hole cut in the casing for the installation of the pitless adaptor/unit to ensure a watertight seal with the pitless adaptor/unit in place;

3. Use a protective well cap that seals tightly against the casing and has a screened vent; and

4. Have native or grout material packed tightly around the casing and discharge pipe after installation.

#### (7) Disinfection.

(A) The permittee shall be responsible for disinfecting a new, repaired, or reconstructed well or pump installation or replacement.

(B) The well, pressure tank, and pumping equipment shall be disinfected with chlorine to achieve a concentration of at least one hundred (100) parts per million (ppm) of chlorine.

(C) The minimum contact period before pumping the well to waste and flushing the chlorine solution from the distribution system is two (2) hours.

(D) When pulling a pump the electrical wire and drop pipe shall not touch the ground. If contamination occurs, disinfect all items prior to reinstallation.

(E) A discharge of chlorinated water to waters of the state shall be reported to the department.

*AUTHORITY: sections 256.606 and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

### 10 CSR 23-3.060 Certification and Registration Reports (Rescinded February 28, 2019)

*AUTHORITY: sections 256.606, 256.614, 256.623 and 256.626, RSMo 2000. Original rule filed April 2, 1987, effective July 27, 1987. Emergency rescission and emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Rescinded and readopted: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed March 30, 2005, effective Oct. 30, 2005. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.*

**10 CSR 23-3.070 Plastic Well Casing**  
(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.606, 256.614, 256.615 and 256.626, RSMo 1994. Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

**10 CSR 23-3.080 Liners**

*PURPOSE:* This rule sets guidelines for the use of liners in water wells.

(1) General specifications. All liners shall—

(A) Be new and follow minimum specifications in Table 3.8. Used pipe is considered new if it is salvaged within ninety (90) days of the installation of a new water well and is decontaminated.

Table 3.8 Minimum liner specifications.

Material	Wall thickness (inches)	Standard Dimension Ratio (SDR)	Schedule (SCH)
Steel	0.188	-	-
Plastic (PVC or ABS only) <sup>1</sup>	-	26	40

<sup>1</sup> Shall meet ASTM standards:

(B) Be suspended securely with a hanger or allowed to rest on bottom of the well;

(C) Be installed so that the top of the liner terminates within ten feet (10') of the top of the casing; and

(D) Be able to withstand forces encountered during installation.

(2) Packers or liner hangers when used shall be secured—

(A) For plastic liners, with screws that do not penetrate the inside of the liner; or

(B) For steel liners, with liner hangers welded or mechanically attached.

(3) Liners are used for three (3) general purposes. The following additional requirements apply based on the purpose of the liner:

(A) To hold the well bore open for any potential collapse or sloughing of loose material—

1. Grout material and packers are optional; and

2. Manufactured slotted liner, pipe-based screens, wire-wrapped liners, or manually perforated liners may be used;

(B) To prevent rust—

1. The liner shall extend from at least five feet (5') below the bottom of the casing to within ten feet (10') of the top of the casing; and

2. Shall have two (2) packers, with the first packer set within five feet (5') below the bottom of the casing and the second packer set inside the casing near the bottom; and

3. Grout material is optional; and

(C) To seal out undesirable conditions or to correct inadequate casing seals—

1. Have a minimum annular space of one-half inch ( $\frac{1}{2}$ "); and

2. Have a minimum of two (2) rubber packers secured below the bottom of the area of concern to be grouted; and

3. Have packers placed a maximum of ten feet (10') apart; and

4. Use one (1) of the following grout materials:

A. Cement slurry; or

B. Coated bentonite pellets; or

C. Other grout materials upon receiving advanced written approval by the department; and

5. Use one (1) of the following grout methods:

A. Gravity; or

B. Tremie; or

C. Other methods upon receiving advanced written approval by the department; and

6. Have a minimum thirty-foot (30') annular seal placed above the packers using specifications provided in Table 3.9; and

7. Have the top of the liner extend to within ten feet (10') of the top of casing; and

8. When used to correct inadequate casing seals, place the top packer twenty five feet (25') below the bottom of the casing. Emplace grout material from above the top packer to a minimum of five feet (5') into the casing for a total of thirty feet (30') of grout.



Table 3.9 Minimum number of bags of grout to achieve an annular grout seal of thirty feet (30') for lining water wells.

Type of Grout	Borehole Diameter (inches)			Outer Diameter of Liner (inches)		
	6	8	10	6	8	10
CEMENT						
Portland Type I	2.2	6.1	11.2	1.5	5.5	10.5
Portland Type II	2.2	6.1	11.2	1.5	5.5	10.5
BENTONITE						
Pellets						
1/4" Baroid Pellets	3.5	9.7	17.8	2.5	8.7	16.7
3/8" Baroid Pellets	3.7	10.3	18.7	2.6	9.2	17.6
1/4" Baroid Pellets	3.7	10.2	18.6	2.6	9.1	17.5
Wyo-bend Tablets	3.9	10.8	19.7	2.7	9.6	18.5
Volclay 1/2"	3.9	10.9	19.9	2.7	9.7	18.7
Volclay 3/4"	4.1	11.3	20.6	2.8	10.1	19.3
Volclay 1"	4.2	11.6	21.2	2.9	10.4	20.0

(4) PVC or ABS liners are prohibited when known gasoline or solvent contamination exists within three hundred feet (300') of the well being repaired or drilled.

(5) It is the responsibility of the permittee to ensure the annulus between the borehole and liner is sealed for a period of three (3) years from the date the well construction or reconstruction is approved by the department, unless it can be proven that the annular seal has been damaged by another person. This applies to wells where the liner is installed to seal out undesirable conditions, correct inadequate grout seals of the casing annulus, and/or any other issue associated with the well casing.

**AUTHORITY:** sections 256.606 and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Emergency rescission and emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expire April 9, 1994. Rescinded and readopted: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.

#### 10 CSR 23-3.090 Drilling Areas

**PURPOSE:** This rule sets construction standards in addition to 10 CSR 23-3.030 Standards for Construction of Water Wells. These additional standards apply to domestic and multifamily wells and vary by geographic area based on geologic, hydrologic, and/or

environmental factors (see Figure 3.1).

(1) Area 1. This area encompasses portions of southwestern, central, east central, and southeastern Missouri (see Figure 3.2).

(A) Bedrock wells.

1. A minimum of eighty feet (80') of casing shall be installed and extend a minimum of thirty feet (30') into solid bedrock. Example: if sixty feet (60') of residual material or broken rock is encountered during drilling above solid bedrock, then ninety feet (90') of casing will be installed.

2. The borehole for a domestic well shall be a minimum of eight and five-eighths inches (8 5/8") in diameter to the casing depth.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. Grouting Requirements.

A. The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. The annular space above the grouted interval shall be filled with clean fill.

(B) Unconsolidated material wells.

1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.

2. The borehole for a domestic well shall be a minimum of ten and five-eighths inches (10 5/8") in diameter to the casing depth. The borehole shall be a minimum of four inches (4") larger in diameter than the casing being installed.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. Grouting Requirements.

A. The upper twenty feet (20') of casing shall be grouted. Table 3.11 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting methods and materials shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the well screen or perforated interval.

(2) Area 2. This area encompasses west central Missouri and is delineated separately because the bedrock has the potential to produce groundwater with high dissolved solids compared to other areas of the state (see Figure 3.3).

(A) Bedrock wells.

1. A minimum of forty feet (40') of casing shall be installed and extend a minimum of fifteen feet (15') into solid bedrock.

2. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8 5/8") in diameter to the casing depth.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. Grouting Requirements.

A. The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

(B) Unconsolidated material wells.

1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.



2. The borehole shall be a minimum of ten and five-eighths inches (10  $\frac{5}{8}$ ") in diameter to the casing depth. The borehole for domestic wells shall be a minimum of four inches (4") larger in diameter.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. Grouting Requirements.

A. The upper twenty feet (20') of casing shall be grouted. Table 3.11 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the well screen or perforated interval.

(3) Area 3. This area encompasses northwestern and north central Missouri and is delineated separately because glacial till overlies bedrock that has the potential to produce groundwater with high dissolved solids compared to other areas of the state (see Figure 3.4).

(A) Bedrock wells.

1. A minimum of forty feet (40') of casing shall be installed and extend a minimum of fifteen feet (15') into solid bedrock.

2. Construct the borehole for domestic wells a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to casing depth.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. The casing shall be a minimum of five and one-half inches (5  $\frac{1}{2}$ ") in diameter and the borehole shall be a minimum of two inches (2") larger in diameter than the casing being installed.

5. Grouting Requirements.

A. The lowermost thirty feet (30') of casing shall be grouted. Table 3.12 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. The annular space above the grouted interval shall be filled with clean fill.

6. Shallow Bedrock Well—If usable quantities of water are not expected to be available in deeper bedrock horizons one (1) of the following construction methods may be used.

A. Method 1.

(I) A minimum of forty feet (40') of casing shall be installed pursuant to 10 CSR 23-3.030(1)(A).

(II) A minimum of one foot (1') of casing shall extend into solid bedrock.

(III) The borehole for domestic wells shall be a minimum of eight and five-eighths (8  $\frac{5}{8}$ ") in diameter to the casing depth.

(IV) The casing shall be a minimum of five and one-half inches (5  $\frac{1}{2}$ ") in diameter and the borehole shall be a minimum of two inches (2") larger in diameter than the casing being installed.

(V) The lower thirty feet (30') of casing shall be grouted. Table 3.12 lists the minimum amount of grout required by type and size of annulus or open hole.

(VI) Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

(VII) The annular space above the grouted interval shall be filled with clean fill.

B. Method 2.

(I) The casing shall be installed full-length pursuant to 10 CSR 23-3.030(1)(A) and perforated below twenty (20') feet across the producing horizon.

(II) The borehole for domestic wells shall be eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter with the upper twenty feet (20') reamed out to ten and five-eighths inches (10  $\frac{5}{8}$ ") in diameter.

(III) The casing shall be a minimum of five and one-half inches (5  $\frac{1}{2}$ ") in diameter.

(IV) The upper twenty feet (20') of annular space shall be grouted and the remainder of the borehole below the grout shall be gravel packed if a packer is not installed. Table 3.13 lists the minimum amount of grout required by type and size of annulus or open hole.

7. All construction requirements pursuant to 10 CSR 23-3.030 shall be met except as stated in 10 CSR 23-3.090(3)(A)6.

(B) Unconsolidated material wells and glacial drift wells.

1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.

2. The borehole for domestic wells shall be a minimum of ten and five-eighths inches (10  $\frac{5}{8}$ ") in diameter to casing depth. The borehole shall be a minimum of four inches (4") larger in diameter than the casing being installed.

3. Well casing shall be a minimum of five and one-half inches (5  $\frac{1}{2}$ ") in diameter.

4. Grouting Requirements.

A. The upper twenty feet (20') of casing shall be grouted. Table 3.13 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the screen or perforated interval.

(4) Area 4. This area encompasses northeastern Missouri and is delineated separately because the glacial till overlies bedrock that has the potential to produce groundwater with high dissolved solids compared to other areas of the state (see Figure 3.5).

(A) Bedrock wells.

1. A minimum of forty feet (40') of casing shall be installed and extend a minimum of fifteen feet (15') into bedrock.

2. Construct the borehole for domestic wells a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to the casing depth.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. The casing shall be a minimum of five and one-half inches (5  $\frac{1}{2}$ ") in diameter and the borehole shall be a minimum of two inches (2") larger in diameter than the casing being installed.

5. Grouting Requirements.

A. The lowermost thirty feet (30') of casing shall be grouted.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. The annular space above the grouted interval shall be filled with clean fill.

6. Shallow bedrock wells - If usable quantities of water are not expected to be available in deeper bedrock horizons the following construction method may be used.

A. Method 1.

(I) A minimum of forty feet (40') of casing shall be installed pursuant to 10 CSR 23-3.030(1)(A).

(II) A minimum of one foot (1') of casing shall extend into solid bedrock.

(III) The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to the casing depth.

(IV) The casing shall be a minimum of five and a half inches (5  $\frac{1}{2}$ ") in diameter and the borehole shall be a minimum of two inches (2") larger in diameter than the casing being installed.

(V) The lower thirty feet (30') of casing shall be grouted. Table 3.12 lists the minimum amount of grout required by type and size of annulus or open hole.

(VI) Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

(VII) The annular space above the grouted interval shall be filled with clean fill.



7. All construction requirements pursuant to 10 CSR 23-3.030 shall be met except as stated in 10 CSR 23-3.090(4)(A)6.

(B) Unconsolidated material wells and glacial drift wells.

1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.

2. The borehole for domestic wells shall be a minimum of ten and five-eighths inches (10  $\frac{5}{8}$ ") in diameter to casing depth. The borehole shall be a minimum of four inches (4") larger in diameter than the casing being installed.

3. Well casing shall be a minimum of five and one-half inches (5  $\frac{1}{2}$ ") in diameter.

4. Grouting Requirements.

A. The upper twenty feet (20') of casing shall be grouted. Table 3.13 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the screen or perforated interval.

(5) Area 5. This area encompasses the Missouri and Mississippi River floodplains and is delineated separately because the uppermost aquifer consists of unconsolidated alluvium (see Figure 3.6).

(A) Bedrock wells.

1. A minimum of eighty feet (80') of casing shall extend a minimum of thirty feet (30') into bedrock.

2. Construct the borehole a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to the casing depth.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. The lowermost thirty feet (30') of casing shall be grouted pursuant to 10 CSR 23-3.030(1)(C). Table 3.10 lists the minimum amount of grout by type and size of annulus or open hole. The annular space above the grouted interval shall be filled with clean fill.

(B) Unconsolidated material wells.

1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.

2. The borehole for domestic wells shall be a minimum of four inches (4") larger than the casing diameter installed. Unconsolidated material wells that have a casing diameter less than four inches (<4") in diameter are exempt from these rules.

3. The upper twenty feet (20') of casing shall be grouted pursuant to 10 CSR 23-

3.030(1)(C). Table 3.14 lists the minimum amount of grout required by type and size of annulus or open hole.

4. A chlorinated gravel pack may be placed into the annular space adjacent to the well screen or native materials may be allowed to collapse against the screen or perforated interval.

5. All construction requirements pursuant to 10 CSR 23-3.030 shall be met except as stated in 10 CSR 23-3.090(5)(B)2. and 3.

(6) Area 6. This area encompasses the St. Francois Mountains and is delineated separately because igneous bedrock, which has low permeability, occurs close to the ground surface (Figure 3.7).

(A) Bedrock wells.

1. Bedrock wells where granite is less than one hundred feet (<100') below the surface.

A. A minimum of forty feet (40') of casing shall be installed and extend a minimum of fifteen feet (15') into solid bedrock. Example: If sixty feet (60') of residual material or broken rock is encountered during drilling above solid bedrock, then seventy-five feet (75') of casing shall be installed.

B. Construct the borehole for domestic wells a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to the casing depth.

C. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

D. The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole. The annular space above the grouted interval shall be filled with clean fill.

E. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

2. Bedrock wells where granite is one hundred feet or more ( $\geq 100'$ ) below the surface.

A. A minimum of eighty feet (80') of casing shall be installed and shall extend a minimum of thirty feet (30') into solid bedrock.

B. Construct the borehole for domestic wells a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to casing depth.

C. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

D. The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole. The annular space above the grouted interval shall be filled with clean fill.

E. Grouting materials and methods shall be followed pursuant to 10 CSR 23-

3.030(1)(C).

(B) Unconsolidated material wells.

1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.

2. The borehole for domestic wells shall be a minimum of ten and five-eighths inches (10  $\frac{5}{8}$ ") in diameter. The borehole shall be a minimum of four inches (4") larger in diameter than the casing being installed.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. The upper twenty feet (20') of casing shall be grouted. Table 3.11 lists the minimum amount of grout required by type and size of annulus or open hole.

5. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

6. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the well screen or perforated interval.

(7) Area 7 (formerly Sensitive Area A). This area encompasses Osage, Gasconade, Maries, and parts of Phelps, Crawford, and Franklin counties and is delineated separately because it is overlain in part by Pennsylvanian-aged bedrock which is capable of producing groundwater with high dissolved solids (see Figure 3.2).

(A) Bedrock Wells.

1. A minimum of eighty feet (80') of casing shall be installed and extend a minimum of thirty feet (30') into solid bedrock. Example: If sixty feet (60') of residual material or broken rock is encountered during drilling above solid bedrock, then ninety feet (90') of casing shall be installed.

2. In areas where Pennsylvanian-age strata (shale, sandstone, and/or clay) are present, a minimum of one hundred fifty feet (150') of casing shall be installed and extend at least thirty feet (30') below the Pennsylvanian age strata (shale, sandstone, and/or clay).

3. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to casing depth.

4. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

5. Grouting Requirements.

A. The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. The annular space above the grouted interval shall be filled with clean fill.





(B) Unconsolidated material wells.

1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.

2. The borehole for domestic wells shall be a minimum of ten and five-eighths inches (10  $\frac{5}{8}$ ") in diameter and a minimum of four inches (4") larger in diameter than the casing being installed.

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

4. Grouting Requirements.

A. The upper twenty feet (20') of casing shall be grouted. Table 3.11 lists the minimum amount of grout required by and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the well screen or perforated interval.

(8) Area 8 (formerly Sensitive Area B). This area encompasses a one-quarter ( $\frac{1}{4}$ ) mile buffer from the twenty foot (20') water depth contour line of major lakes in Missouri (see Figure 3.2).

(A) The major lakes include:

1. Truman;
2. Stockton;
3. Table Rock;
4. Bull Shoals;
5. Lake of the Ozarks;
6. Pomme de Terre;
7. Norfolk; and
8. Clearwater.

(B) Bedrock Wells.

1. Casing shall be installed fifty feet (50') below the deepest point of the lake within one-quarter ( $\frac{1}{4}$ ) mile radius of the well location. Casing shall not be less than the minimum requirements outlined in Drill Area 1 (10 CSR 23.090(1)) a minimum of eighty feet (80') and extend thirty feet (30') into bedrock. Formula: well site elevation (feet) - deepest lake elevation within one-quarter ( $\frac{1}{4}$ ) mile (feet) + fifty feet (50') = casing depth. Example: 1000' (well site elevation) - 850' (deepest lake elevation within one-quarter ( $\frac{1}{4}$ ) mile) + 50' = 200' casing depth.

2. A casing point may be requested prior to drilling in Drill Area 8.

3. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to casing depth.

4. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

5. When plastic casing is used liner shall not be used in lieu of casing.

6. When steel casing is used and the minimum casing depth cannot be achieved due to geologic reasons, casing shall be installed to a minimum of eighty feet (80') extending a minimum of thirty feet (30') into bedrock and a liner used to achieve the remaining casing depth provided the following requirements are met:

A. Have a minimum annular space of one-half inch ( $\frac{1}{2}$ ");

B. Have a minimum of two (2) three- (3-) ribbed rubber packers (K-packers) secured at or below the bottom of the minimum casing depth;

C. Have the top of the liner extend to within ten feet (10') of the top of casing;

D. Have packers placed a maximum of ten feet (10') apart;

E. Grout pursuant to 10 CSR 23-3.090(8)(B)7. using the gravity or tremie grouting method using cement slurry or coated bentonite pellets; and

F. Liner specifications shall be followed pursuant to 10 CSR 23-3.080(1), (2), (4), and (5).

7. Grouting Requirements.

A. The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. The annular space above the grouted interval shall be filled with clean fill.

(C) Unconsolidated material wells. The unconsolidated requirements for the Drill Area adjacent to the lake apply.

(9) Area 9 (formerly Sensitive Area C). This area encompasses Greene and parts of Christian county where rapid urbanization is occurring in a sensitive geologic and hydrologic setting. The upper aquifer (Springfield Plateau Aquifer) and lower aquifer (Ozark Aquifer) are separated by low-permeability bedrock (Ozark Confining Unit). This low-permeability bedrock limits migration of groundwater and any associated contamination from the upper aquifer to the lower aquifer (see Figure 3.2).

(A) Bedrock Wells.

1. The casing shall be installed a minimum of ten feet (10') below the Ozark Confining Unit or as indicated in the digital geospatial dataset "DRILL AREAS" developed by the Missouri Department of Natural Resources, Missouri Geological Survey. Hard copies may be obtained by contacting the Missouri Department of Natural Resources, Missouri Geological Survey, 111 Fairgrounds Road, Rolla, MO 65401.

2. A casing point request may be submitted to the department.

3. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8  $\frac{5}{8}$ ") in diameter to casing depth.

4. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

5. When plastic casing is used liner shall not be used in lieu of casing.

6. When steel casing is used and the minimum casing depth cannot be achieved due to geologic reasons, casing shall be installed to a minimum of one hundred feet (100') extending a minimum of thirty feet (30') into bedrock and a liner used to achieve the remaining casing depth provided the following requirements are met:

A. Have a minimum annular space of one-half inch ( $\frac{1}{2}$ ");

B. Have a minimum of two (2) three- (3-) ribbed rubber packers (K-packers) secured at or below the bottom of the Ozark Confining Unit pursuant to 10 CSR 23-3.090(9)(A)1.;

C. Have the top of the liner extend to within ten feet (10') of the top of casing;

D. Have packers placed a maximum of ten feet (10') apart;

E. Grout pursuant to 10 CSR 23-3.090(9)(A)7. using the gravity or tremie grouting method using cement slurry or coated bentonite pellets; and

F. Liner specifications shall be followed pursuant to 10 CSR 23-3.080(1), (2), (4), and (5).

7. Grouting Requirements.

A. The Ozark Confining Unit shall be grouted from ten feet (10') below the formation to the top of the shale and at a minimum the lowermost thirty feet (30') of casing shall be grouted.

B. When the casing extends more than ten feet (10') below the bottom of the Ozark Confining Unit, more than thirty feet (30') of grout will be required to seal off the Ozark Confining Unit.

C. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

D. The annular space above the grouted interval shall be filled with clean fill.

(B) Unconsolidated material wells. The unconsolidated requirements for Drill Area 1 apply.

(10) Area 10 (formerly Special Area 1). This area encompasses a portion of southeastern Missouri and is composed of deeply weathered and highly fractured bedrock where openings may be filled with mud extending deep into bedrock (see Figure 3.8).

(A) Bedrock Wells.



1. A minimum of eighty feet (80') of casing shall be installed and extend a minimum of fifteen feet (15') into solid bedrock. Example: If sixty feet (60') of residual material or broken rock is encountered during drilling above solid bedrock, then seventy five feet (75') of casing shall be installed. If solid bedrock is not encountered within one hundred and fifty feet (150') the contractor may consult the department for further instructions regarding a variance or install casing into deeper solid bedrock.

2. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8 5/8") in diameter to casing depth.

3. In areas where poor drilling conditions exist and it is necessary to drive multiple strings of smaller diameter casing through the surface casing, each succeeding smaller diameter casing shall extend into the preceding casing at least twenty feet (20').

4. Install new steel casing pursuant to 10 CSR 23-3.030(1)(A).

5. Grouting Requirements.

A. If casing is driven, see 10 CSR 23-3.030(1)(D) for liner and grouting requirements.

B. If casing is not driven, the lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

(I) Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

(II) The annular space above the grouted interval shall be filled with clean fill.

(B) If unconsolidated material wells are drilled in Area 10, Drill Area 1 requirements for unconsolidated wells apply.

(11) Area 11 (formerly Special Area 2). This area encompasses Newton and Jasper County and is delineated separately due to the contamination of portions of the upper aquifer by one (1) or more of the following: lead, cadmium, chlorinated VOCs including TCE, TCE degradation products, or other contaminants pursuant to 10 CSR 60-4. The upper aquifer (Springfield Plateau Aquifer) and lower aquifer (Ozark Aquifer) are separated by low-permeability bedrock (Ozark Confining Unit). This low-permeability bedrock limits migration of groundwater and any associated contamination from the upper aquifer to the lower aquifer (see Figure 3.2).

(A) Bedrock Wells.

1. Consult the digital geospatial dataset "DRILL AREAS" developed by the Missouri Department of Natural Resources, Missouri Geological Survey. Hard copies may be obtained by contacting the Missouri

Department of Natural Resources, Missouri Geological Survey, 111 Fairgrounds Road, Rolla, MO 65401. This dataset identifies the maximum well depth for wells completed in the upper aquifer; the required casing depth for a lower aquifer well; and Impact Areas.

2. Wells outside of Impact Areas may be installed in the upper aquifer provided they do not penetrate the Ozark Confining Unit; or wells may be installed and cased/sealed through the Ozark Confining Unit and open to only the lower aquifer.

3. New upper aquifer wells outside of Impact Areas.

A. Total depth of the well shall not penetrate the Ozark Confining Unit and not exceed the upper depth indicated digital geospatial dataset "DRILL AREAS".

B. A minimum of eighty feet (80') of casing shall be installed and extend a minimum of thirty feet (30') into solid bedrock. Example: If sixty feet (60') of residual material or broken rock is encountered during drilling above solid bedrock, then ninety feet (90') of casing will be installed.

C. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8 5/8") in diameter to casing depth.

D. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

E. Grouting Requirements.

(I) The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

(II) Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

(III) The annular space above the grouted interval shall be filled with clean fill.

F. New upper aquifer wells shall follow sampling requirements pursuant to 10 CSR 23-3.090(11)(A)6.

4. New lower aquifer wells outside of the Impact Areas.

A. The casing shall be installed a minimum of ten feet (10') below the Ozark Confining Unit or to the lower depth indicated on the digital geospatial dataset "DRILL AREAS".

B. A casing point request may be submitted to the department.

C. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

D. If steel casing is used, the borehole shall be a minimum of eight and five-eighths inches (8 5/8") in diameter to casing depth.

E. When steel casing is used and the minimum casing depth cannot be achieved due to geologic reasons, casing shall be installed to a minimum of eighty feet (80')

extending thirty feet (30') into bedrock and a liner used to achieve the remaining casing depth provided the following requirements are met:

(I) Have a minimum annular space of one-half inch (1/2");

(II) Have a minimum of two (2) three- (3-) ribbed rubber packers (K-packers) secured at or below the bottom of the Ozark Confining Unit pursuant to 10 CSR 23-3.090(11)(A)4.A.;

(III) Have the top of the liner extend to within ten feet (10') of the top of casing;

(IV) Have packers placed a maximum of ten feet (10') apart;

(V) Grout pursuant to 10 CSR 23-3.090(11)(A)4.G. from the top packer to extend ten feet (10') inside the casing using the gravity or tremie grouting method using cement slurry or coated bentonite pellets; and

(VI) Liner specifications shall be followed pursuant to 10 CSR 23-3.080(1), (2), (4), and (5).

F. If plastic casing is used, the borehole shall be a minimum of ten inches (10") in diameter to the casing depth. When plastic casing is used liner shall not be used in lieu of casing.

G. Grouting Requirements.

(I) Full length grout is required.

(II) Grouting methods shall be Tremie Pressure, Pressure, or Positive Displacement pursuant to 10 CSR 23-3.030(1)(C)1.C., 10 CSR 23-3.030(1)(C)1.D., and 10 CSR 23-3.030(1)(C)1.F.

(III) Grouting materials shall be cement slurry or high-solids bentonite slurry.

(IV) Wells with eighty feet (80') of casing may use grouting materials and methods pursuant to 10 CSR 23-3.030(1)(C).

H. All construction requirements pursuant to 10 CSR 23-3.030 shall be met except as provided in 10 CSR 23-3.090(11)(A)4.G.

5. Major reconstruction of wells in Area 11 that involve exceeding the upper depth indicated in the digital geospatial dataset "DRILL AREAS" or penetrating the Ozark Confining Unit requires advanced written approval from the department.

6. Sampling Requirements for new upper aquifer wells.

A. Water sampling and analysis shall be performed for lead, cadmium, TCE and its degradation products for new wells.

B. Permitted pump installers and owners who self-install pumps are responsible for ensuring sampling is completed according to laboratory sampling protocol and submitting sample results within sixty (60) days of pump installation.



C. The laboratory that analyzes the sample shall be certified by the EPA or the department for such analyses.

D. Prior to sampling, the well shall be purged continuously for a minimum of two (2) hours and water samples collected from the tap closest to the well.

E. All new upper aquifer wells shall be constructed with a sampling port or tap within twenty feet (20') of the wellhead.

F. If an upper aquifer well contains levels of lead, cadmium, TCE or its degradation products that are above MCL or AL, the well shall—

(I) Be plugged full length with approved grout material; or

(II) Be reconstructed and sealed through the Ozark Confining Unit pursuant to 10 CSR 23-3.090(11)(A)5.

7. Well installation in Impact Areas.

A. The casing shall be installed a minimum of ten feet (10') below the Ozark Confining Unit or to the lower depth indicated in the digital geospatial dataset "DRILL AREAS".

B. A casing point request may be submitted to the department.

C. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

D. The borehole shall be a minimum of ten inches (10") in diameter to casing depth.

E. Grouting Requirements.

(I) Full length grout is required.

(II) Grouting methods shall be Tremie Pressure, Pressure, or Positive Displacement pursuant to 10 CSR 23-3.030(1)(C)1.C., 10 CSR 23-3.030(1)(C)1.D., and 10 CSR 23-3.030(1)(C)1.F.

(III) Grouting materials shall be cement slurry or high-solids bentonite slurry.

(B) Unconsolidated Material Wells.

1. If unconsolidated material wells are drilled in Area 11 outside of Impact areas, Drill Area 1 requirements for unconsolidated wells apply.

2. Advanced written approval from the department is required if unconsolidated material wells are drilled in Impact Areas.

(12) Area 12 (formerly Special Area 3). This area encompasses portions of Franklin County within and south of the city of New Haven and is delineated separately due to the contamination of portions of the aquifer by one (1) or more of the following known contaminants: tetrachloroethylene or perchloroethylene (PCE), trichloroethylene (TCE), TCE degradation products, and may include other contaminants pursuant to 10 CSR 60-4. It is necessary to implement more

stringent well construction standards for new wells that are drilled into the aquifer and to limit the deepening of existing upper aquifer wells (see Figure 3.9).

(A) New Wells.

1. Prior written approval and construction specifications shall be obtained from the department for any new wells constructed in Area 12.

2. Water sampling for contaminants will be required pursuant to 10 CSR 23-3.090(12)(C).

3. Drilling shall cease and the department is to be notified immediately if PCE or TCE is encountered above the maximum contaminant level (MCL) or action level (AL). The department will determine further action.

(B) Reconstruction of Existing Wells.

1. Prior written approval and reconstruction specifications shall be obtained from the department for any reconstructed wells in Area 12.

2. Water sampling for contaminants will be required pursuant to 10 CSR 23-3.090(12)(C). Wells that are contaminated at levels exceeding maximum contaminant levels (MCLs) and/or action levels (ALs) shall not be deepened.

3. Drilling shall cease and the department is to be notified immediately if PCE or TCE is encountered above the maximum contaminant level (MCL) or action level (AL) during reconstruction. The department will determine further action.

(C) Water Sampling.

1. Groundwater sampling for contaminants is required according to laboratory sampling protocol for any new well or reconstruction and methods will be established on a case-by-case basis by the department.

2. The well installation contractor is responsible for ensuring sampling is conducted throughout the drilling process and results submitted in accordance with pre-approved department sampling methods. Final sampling of the well shall be completed by the pump installation contractor within sixty (60) days of pump installation. Wells will not be certified or registered until all sampling has been completed.

3. Sampling and analysis shall be performed for known contaminants listed in 10 CSR 23-3.090(12) and other contaminants as determined by the department.

4. The laboratory that analyzes the sample shall be certified by the EPA or the department for analyses being requested.

5. All new and deepened wells shall be constructed with a sampling port or tap at or before the pressure tank within twenty feet (20') of the wellhead.

(D) Plugging.

1. Wells shall be plugged full length using bentonite slurry or cement grout via one (1) of the tremie methods.

2. All plugging requirements in 10 CSR 23-3.110 shall be met except as required in 10 CSR 23-3.090(12)(D).

(E) All drilling-derived fluids, displaced water, and solid materials shall be containerized and sampled before disposal in accordance with federal, state, and local regulations based on analytical results.

(F) Any completed (new or reconstructed) well in which PCE and/or TCE is encountered at levels above MCL and/or AL shall be plugged full-length pursuant to 10 CSR 23-3.090(12)(D).

(13) Area 13 (formerly Special Area 4). This area encompasses portions of St. Charles County west of the city of Weldon Spring and is delineated separately due to contamination of portions of the aquifer by one (1) or more of the following known contaminants listed by source in Table 3.15. In this area it is necessary to implement more stringent well construction standards for new wells that are drilled into the aquifer and to limit the deepening of existing upper aquifer wells (see Figure 3.10).





Table 3.15. Known contaminants of Drill Area 13 by source.

Source	Known Contaminants <sup>1</sup>
U.S. Army	2,4,6-FNT, 2,4-DNT, 2,6-DNT, dinitrobenzene (1,3-DNB), nitrobenzene (NB), ortho-nitrotoluene (o-NT), meta-nitrotoluene (m-NT), para-nitrotoluene (p-NT)
Department of Energy Main Site	2,4,6-TNT, 2,4-DNT, 2,6-DNT, dinitrobenzene (1,3-DNB), nitrobenzene (NB), nitrate, uranium, and trichloroethylene (TCE)
Department of Energy Quarry	uranium and 2,4-DNT

<sup>1</sup>May also include other contaminants pursuant to 10 CSR 60-4.

(A) New Wells.

1. Prior written approval and construction specifications shall be obtained from the department for any wells constructed in Area 13.

2. Water sampling for contaminants will be required pursuant to 10 CSR 23-3.090(13)(C).

3. Drilling shall cease and the department is to be notified immediately if contaminants listed in Table 3.15 or other contaminants pursuant to 10 CSR 60-4 are encountered at levels above the maximum contaminant level (MCL), action level (AL), remedial goals stated in the Record of Decisions, and/or the risk-based value(s) calculated in the most recent site five- (5-) year review. The department will determine further action.

(B) Reconstruction of Existing Wells.

1. Prior written approval and construction specifications shall be obtained from the department for any reconstructed wells in Area 13.

2. Groundwater sampling for contaminants listed in Table 3.15 or other contaminants pursuant to 10 CSR 60-4 will be required in advance of any deepening. Wells that are contaminated at levels exceeding maximum contaminant level (MCL), action level (AL), remedial goals stated in the Record of Decisions, and/or the risk-based value(s) calculated in the most recent site five- (5-) year review shall not be deepened.

3. Any well approved to be deepened which encounters contaminants listed in Table 3.15 or other contaminants pursuant to 10 CSR 60-4 at levels above maximum contaminant level (MCL), action level (AL), remedial goals stated in the Record of Decisions, and/or the risk-based value(s) calculated in the most recent site five- (5-) year review, drilling shall cease and the department shall be notified immediately. The department will determine further action.

(C) Water Sampling.

1. Groundwater sampling for contaminants is required according to laboratory sampling protocol for any new well or reconstruction and methods will be established on a case-by-case basis by the department.

2. The well installation contractor is responsible for ensuring sampling is conducted throughout the drilling process and results submitted in accordance with pre-approved department sampling methods. Final sampling of the well shall be completed by the pump installation contractor within sixty (60) days of pump installation. Wells will not be certified or registered until all sampling has been completed.

3. Sampling and analysis shall be performed for contaminants listed in Table 3.15.

4. The laboratory that analyzes the sample shall be certified by the EPA or the department for such analyses.

5. All new and deepened wells shall be constructed with a sampling port or tap at or before the pressure tank within twenty feet (20') of the wellhead.

(D) Plugging.

1. Wells shall be plugged full length using bentonite slurry or cement grout via one (1) of the tremie methods.

2. All plugging requirements in 10 CSR 23-3.110 shall be met except as required in 10 CSR 23-3.090(13)(D).

(E) All drilling-derived fluids, displaced water, and solid materials shall be containerized and sampled before disposal in accordance with federal, state, and local regulations based on analytical results.

(F) Any completed (new or reconstructed) well in which contaminants listed in Table 3.15 or other contaminants pursuant to 10 CSR 60-4 are encountered at levels above the maximum contaminant level (MCL), action level (AL), remedial goals stated in the Record of Decisions, and/or the risk-based value(s) calculated in the most recent site five- (5-) year review shall be plugged full-length (10 CSR 23-3.090(13)(D)) or with approval from the department the well owner may be allowed to use the well provided groundwater quality will not be degraded further.

(G) Notwithstanding these provisions, the

federal government does not waive its rights and authority under federal law, regulations, or executive order within the boundaries and applicable jurisdiction of federal property.



Table 3.10 All Drilling Areas (Bedrock Water Wells). Minimum Number of Bags of Grout Required in Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing with a Minimum Grout Seal of Thirty Feet (30').

Type of Grout	Casing Outer Diameter 6 5/8" (6" NOMINAL) -- APPLIES TO ALL DRILLING AREAS											
	Borehole Diameter (inches)											
	8 3/4"			8 3/4"			9			9 1/2"		
	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.
<b>CEMENT</b>												
Portland Type I	4.3	10.4	4.6	10.7	5.2	11.3	6.5	12.6	7.8	14.0	9.6	15.8
Portland Type III	4.3	10.4	4.6	10.7	5.2	11.3	6.5	12.6	7.8	14.0	9.6	15.8
<b>BENTONITE</b>												
<b>Pellets</b>												
1/2" Baroid Pellets	6.8	16.6	7.3	17.1	8.3	18.0	10.3	20.1	12.5	22.3	15.4	25.2
3/4" Baroid Pellets	7.2	17.5	7.7	18.0	8.7	19.0	10.9	21.2	13.2	23.5	16.2	26.5
1/4" Baroid Pellets	7.1	17.4	7.6	17.9	8.7	18.9	10.8	21.1	13.1	23.4	16.1	26.4
Wyo-Bend Tablets	7.5	18.4	8.1	18.9	9.2	20.0	11.4	22.3	13.9	24.7	17.0	27.9
Volclay 1/2"	7.6	18.6	8.2	19.1	9.3	20.2	11.6	22.6	14.0	25.0	17.2	28.2
Volclay 3/8"	7.9	19.2	8.4	19.7	9.6	20.9	12.0	23.3	14.5	25.8	17.8	29.1
Volclay 1/4"	8.1	19.8	8.7	20.4	9.9	21.6	12.3	24.0	14.9	26.6	18.4	30.0
<b>Chips</b>												
Baroid HolePlug	7.2	17.7	7.8	18.2	8.8	19.2	11.0	21.4	13.3	23.7	16.4	26.8
Wyo-Bend Coarse	6.1	14.8	6.5	15.2	7.4	16.1	9.2	18.0	11.2	19.9	13.7	22.5
Wyo-Bend Medium	6.3	15.3	6.7	15.7	7.6	16.7	9.5	18.6	11.5	20.6	14.2	23.2
Volclay Coarse	6.7	16.4	7.2	16.8	8.2	17.8	10.2	19.9	12.3	22.0	15.2	24.8
Volclay Medium	6.9	16.8	7.4	17.3	8.4	18.3	10.5	20.4	12.7	22.6	15.6	25.5
<b>Granular</b>												
Benseal	6.3	15.3	6.7	15.8	7.7	16.7	9.6	18.6	11.6	20.6	14.2	23.3
Wyo-bend No. 8	6.1	14.8	6.5	15.2	7.4	16.1	9.2	18.0	11.2	19.9	13.7	22.5
Wyo-bend No. 16	6.1	14.8	6.5	15.2	7.4	16.1	9.2	18.0	11.2	19.9	13.7	22.5
<b>Slurry</b>												
Baroid	1.5	3.6	1.6	3.7	1.8	3.9	2.3	4.4	2.7	4.9	3.4	5.5
Hi-yield	1.1	2.7	1.2	2.8	1.3	2.9	1.7	3.3	2.0	3.6	2.5	4.1
Wyo-bend	1.6	3.8	1.7	3.9	1.9	4.2	2.4	4.6	2.9	5.1	3.6	5.8
Volclay	1.4	3.5	1.5	3.6	1.7	3.8	2.2	4.2	2.6	4.6	3.2	5.3



Table 3.11 All Drilling Areas (Unconsolidated Water Wells). Minimum Number of Bags of Grout Required in Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing with a Minimum Upper Grout Seal of Twenty Feet (20').

Type of Grout	Casing Outer Diameter 6 5/8" (6" Nominal) – Applies to All Drilling Areas															
	Borehole Diameter (inches)															
	10 %	12 %	14 %	16	18	20	24									
	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.
<b>CEMENT</b>																
Portland Type I	6.4	10.5	10.8	14.9	15.9	20.0	19.8	23.9	26.1	30.2	33.2	37.3	49.6	53.7		
Portland Type III	6.4	10.5	10.8	14.9	15.9	20.0	19.8	23.9	26.1	30.2	33.2	37.3	49.6	53.7		
<b>BENTONITE</b>																
<b>Pellets</b>																
1/2" Baroid Pellets	10.3	16.8	17.2	23.7	25.3	31.8	31.5	38.0	41.6	48.1	52.9	59.4	79.0	85.6		
3/4" Baroid Pellets	10.8	17.7	18.1	25.0	26.6	33.5	33.2	40.1	43.8	50.7	55.7	62.6	83.3	90.2		
1/4" Baroid Pellets	10.8	17.6	18.0	24.9	26.5	33.4	33.0	39.9	43.6	50.5	55.5	62.3	82.9	89.8		
Wyo-Bend Tablets	11.4	18.6	19.0	26.3	28.0	35.2	34.9	42.1	46.1	53.3	58.6	65.8	87.6	94.8		
Volclay 1/2"	11.5	18.8	19.3	26.6	28.3	35.7	35.3	42.7	46.7	54.0	59.3	66.7	88.7	96.0		
Volclay 3/4"	11.9	19.4	19.9	27.4	29.2	36.8	36.4	44.0	48.1	55.7	61.2	68.8	91.4	99.0		
Volclay 1/4"	12.2	20.0	20.5	28.3	30.2	38.0	37.6	45.4	49.7	57.5	63.2	71.0	94.4	102.2		
<b>Chips</b>																
Baroid HolePlug	10.9	17.9	18.3	25.2	26.9	33.9	33.6	40.5	44.3	51.3	56.3	63.3	84.2	91.1		
Wyo-Bend Coarse	9.2	15.0	15.3	21.2	22.6	28.4	28.1	34.0	37.2	43.0	47.3	53.1	70.6	76.4		
Wyo-Bend Medium	9.5	15.5	15.9	21.9	23.3	29.4	29.1	35.1	38.4	44.4	48.8	54.9	73.0	79.0		
Volclay Coarse	10.1	16.6	17.0	23.4	24.9	31.4	31.1	37.5	41.1	47.5	52.2	58.7	78.0	84.5		
Volclay Medium	10.4	17.0	17.4	24.0	25.6	32.3	32.0	38.6	42.2	48.8	53.7	60.3	80.2	86.8		
<b>Granular</b>																
Benseal	9.5	15.5	15.9	21.9	23.4	29.4	29.2	35.2	38.5	44.6	49.0	55.0	73.2	79.2		
Wyo-bend No. 8	9.2	15.0	15.3	21.2	22.6	28.4	28.1	34.0	37.2	43.0	47.3	53.1	70.6	76.4		
Wyo-bend No. 16	9.2	15.0	15.3	21.2	22.6	28.4	28.1	34.0	37.2	43.0	47.3	53.1	70.6	76.4		
<b>Slurry</b>																
Baroid	2.2	3.7	3.7	5.2	5.5	6.9	6.9	8.3	9.1	10.5	11.5	13.0	17.2	18.7		
Hi-yield	1.7	2.7	2.8	3.9	4.1	5.2	5.1	6.2	6.8	7.8	8.6	9.7	12.9	13.9		
Wyo-bend	2.4	3.9	4.0	5.5	5.8	7.3	7.3	8.8	9.6	11.1	12.2	13.7	18.2	19.7		
Volclay	2.1	3.5	3.6	4.9	5.3	6.6	6.6	7.9	8.7	10.0	11.0	12.4	16.5	17.8		



Table 3.12 Drilling Areas 3 and 4 (Bedrock or Shallow Bedrock Wells Method 1 Using Five and One-half Inch (5 1/2") Casing Diameter). Minimum Number of Bags of Grout Required in Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing with a Minimum Grout Seal of Thirty Feet (30').

**CASING OUTER DIAMETER 5 1/2" (5" NOMINAL) — APPLIES TO DRILLING AREAS 3 AND 4 ONLY**

Type of Grout	Borehole Diameter (inches)					
	9 1/2"		10"		10 3/4"	
	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.
<b>CEMENT</b>						
Portland Type I	8.4	12.6	9.8	14.0	11.6	15.8
Portland Type III	8.4	12.6	9.8	14.0	11.6	15.8
<b>BENTONITE</b>						
<b>Pellets</b>						
1/2" Baroid Pellets	13.4	20.1	15.5	22.3	18.4	25.2
3/4" Baroid Pellets	14.1	21.2	16.4	23.5	19.4	26.5
1/4" Baroid Pellets	14.0	21.1	16.3	23.4	19.3	26.4
Wyo-Bend Tablets	14.8	22.3	17.2	24.7	20.4	27.9
Volclay 1/2"	15.0	22.6	17.4	25.0	20.7	28.2
Volclay 3/8"	15.5	23.3	18.0	25.8	21.3	29.1
Volclay 1/4"	16.0	24.0	18.6	26.6	22.0	30.1
<b>Chips</b>						
Baroid Hole Plug	14.2	21.4	16.6	23.7	19.6	26.8
Wyo-Bend Coarse	11.9	18.0	13.9	19.9	16.5	22.5
Wyo-Bend Medium	12.3	18.6	14.3	20.6	17.0	23.2
Volclay Coarse	13.2	19.9	15.3	22.0	18.2	24.9
Volclay Medium	13.6	20.4	15.8	22.6	18.7	25.5
<b>Granular</b>						
Benseal	12.4	18.6	14.4	20.6	17.1	23.3
Wyo-bend No. 8	11.9	18.0	13.9	19.9	16.5	22.5
Wyo-bend No. 16	11.9	18.0	13.9	19.9	16.5	22.5
<b>Slurry</b>						
Baroid	2.9	4.4	3.4	4.9	4.0	5.5
Hi-yield	2.2	3.3	2.5	3.6	3.0	4.1
Wyo-Bend	3.1	4.6	3.6	5.1	4.3	5.8
Volclay	2.8	4.2	3.2	4.6	3.8	5.3



Table 3.13 Drilling Areas 3 and 4 (Unconsolidated or Shallow Bedrock Water Wells Method 2 Using Five and One-half Inch (5 1/2") Casing Diameter). Minimum Number of Bags of Grout Required in the Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing with a Minimum Upper Grout Seal of Twenty (20').

Type of Grout	Casing Outer Diameter 5 1/2" (5" Nominal) – Applies to Drilling Areas 3 and 4 Only.															
	Borehole Diameter (inches)															
	10 1/8"		12 1/8"		14 1/8"		16"		18"		20"		24"			
	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.	Ann.	O.H.
<b>CEMENT</b>																
Portland Type I	7.7	10.5	12.1	14.9	17.1	20.0	20.0	23.9	27.4	30.2	34.5	37.3	50.9	53.7		
Portland Type III	7.7	10.5	12.1	14.9	17.1	20.0	20.0	23.9	27.4	30.2	34.5	37.3	50.9	53.7		
<b>BENTONITE</b>																
<b>Pellets</b>																
1/2" Baroid Pellets	12.3	16.8	19.2	23.7	27.3	31.8	31.5	38.0	43.6	48.1	54.9	59.4	81.1	85.6		
3/4" Baroid Pellets	13.0	17.7	20.2	25.0	28.8	33.5	33.2	40.1	46.0	50.7	57.9	62.6	85.4	90.2		
1/4" Baroid Pellets	12.9	17.6	20.1	24.9	28.6	33.4	33.1	39.9	45.8	50.5	57.6	62.3	85.0	89.8		
Wyo-Bend Tablets	13.6	18.6	21.3	26.3	30.2	35.2	34.9	42.1	48.3	53.3	60.8	65.8	89.8	94.8		
Volclay 1/2"	13.8	18.8	21.5	26.6	30.6	35.7	35.4	42.7	49.0	54.0	61.6	66.7	91.0	96.0		
Volclay 3/4"	14.2	19.4	22.2	27.4	31.6	36.8	36.5	44.0	50.5	55.7	63.6	68.8	93.8	99.0		
Volclay 1/4"	14.7	20.0	22.9	28.3	32.6	38.0	37.6	45.4	52.1	57.5	65.6	71.0	96.8	102		
<b>Chips</b>																
Baroid HolePlug	13.1	17.9	20.5	25.2	29.1	33.9	33.6	40.5	46.5	51.3	58.5	63.3	86.4	91.1		
Wyo-Bend Coarse	11.0	15.0	17.2	21.2	24.4	28.4	28.1	34.0	39.0	43.0	49.1	53.1	72.4	76.4		
Wyo-Bend Medium	11.3	15.5	17.7	21.9	25.2	29.4	29.1	35.1	40.3	44.4	50.7	54.9	74.8	79.0		
Volclay Coarse	12.1	16.6	19.0	23.4	27.0	31.4	31.1	37.5	43.1	47.5	54.2	58.7	80.0	84.5		
Volclay Medium	12.5	17.0	19.5	24.0	27.7	32.3	32.0	38.6	44.3	48.8	55.7	60.3	82.2	86.8		
<b>Granular</b>																
Benseal	11.4	15.5	17.8	21.9	25.3	29.4	29.2	35.2	40.4	44.6	50.8	55.0	75.0	79.2		
Wyo-bend No. 8	11.0	15.0	17.2	21.2	24.4	28.4	28.1	34.0	39.0	43.0	49.1	53.1	72.4	76.4		
Wyo-bend No. 16	11.0	15.0	17.2	21.2	24.4	28.4	28.1	34.0	39.0	43.0	49.1	53.1	72.4	76.4		
<b>Slurry</b>																
Baroid	2.7	3.7	4.2	5.2	6.0	6.9	6.9	8.3	9.5	10.5	12.0	13.0	17.7	18.7		
Hi-yield	2.0	2.7	3.1	3.9	4.4	5.2	5.1	6.2	7.1	7.8	8.9	9.7	13.2	13.9		
Wyo-bend	2.8	3.9	4.4	5.5	6.3	7.3	7.3	8.8	10.1	11.1	12.7	13.7	18.7	19.7		
Volclay	2.6	3.5	4.0	4.9	5.7	6.6	6.6	7.9	9.1	10.0	11.5	12.4	16.9	17.8		



Table 3.14 Drill Area 5 (Unconsolidated Water Wells Using Four and One-half Inch (4 1/2") Casing Diameter). Minimum Number of Bags of Grout Required in Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing with a Minimum Upper Grout Seal of Twenty Feet (20').

CASING OUTER DIAMETER 4 1/2" (4" NOMINAL) — APPLIES TO DRILLING AREA 5 ONLY

Type of Grout	Borehole Diameter (inches)		
	8 1/2"	9"	
<b>CEMENT</b>			
Portland Type I	4.8	6.7	5.7 7.6
Portland Type III	4.8	6.7	5.7 7.6
<b>BENTONITE</b>			
<b>Pellets</b>			
1/2" Baroid Pellets	7.7	10.7	9.0 12.0
3/8" Baroid Pellets	8.1	11.3	9.5 12.7
1/4" Baroid Pellets	8.1	11.3	9.5 12.6
Wyo-Bend Tablets	8.6	11.9	10.0 13.3
Volclay 1/2"	8.7	12.0	10.1 13.5
Volclay 3/8"	8.9	12.4	10.4 13.9
Volclay 1/4"	9.2	12.8	10.8 14.4
<b>Chips</b>			
Baroid Hole Plug	8.2	11.4	9.6 12.8
Wyo-Bend Coarse	6.9	9.6	8.1 10.7
Wyo-Bend Medium	7.1	9.9	8.3 11.1
Volclay Coarse	7.6	10.6	8.9 11.9
Volclay Medium	7.8	10.9	9.2 12.2
<b>Granular</b>			
Benseal	7.2	9.9	8.4 11.1
Wyo-bend No. 8	6.9	9.6	8.1 10.7
Wyo-bend No. 16	6.9	9.6	8.1 10.7
<b>Slurry</b>			
Baroid	1.7	2.3	2.0 2.6
Hi-yield	1.3	1.7	1.5 2.0
Wyo-Bend	1.8	2.5	2.1 2.8
Volclay	1.6	2.2	1.9 2.5

Figure 3.1 All Drilling Areas.

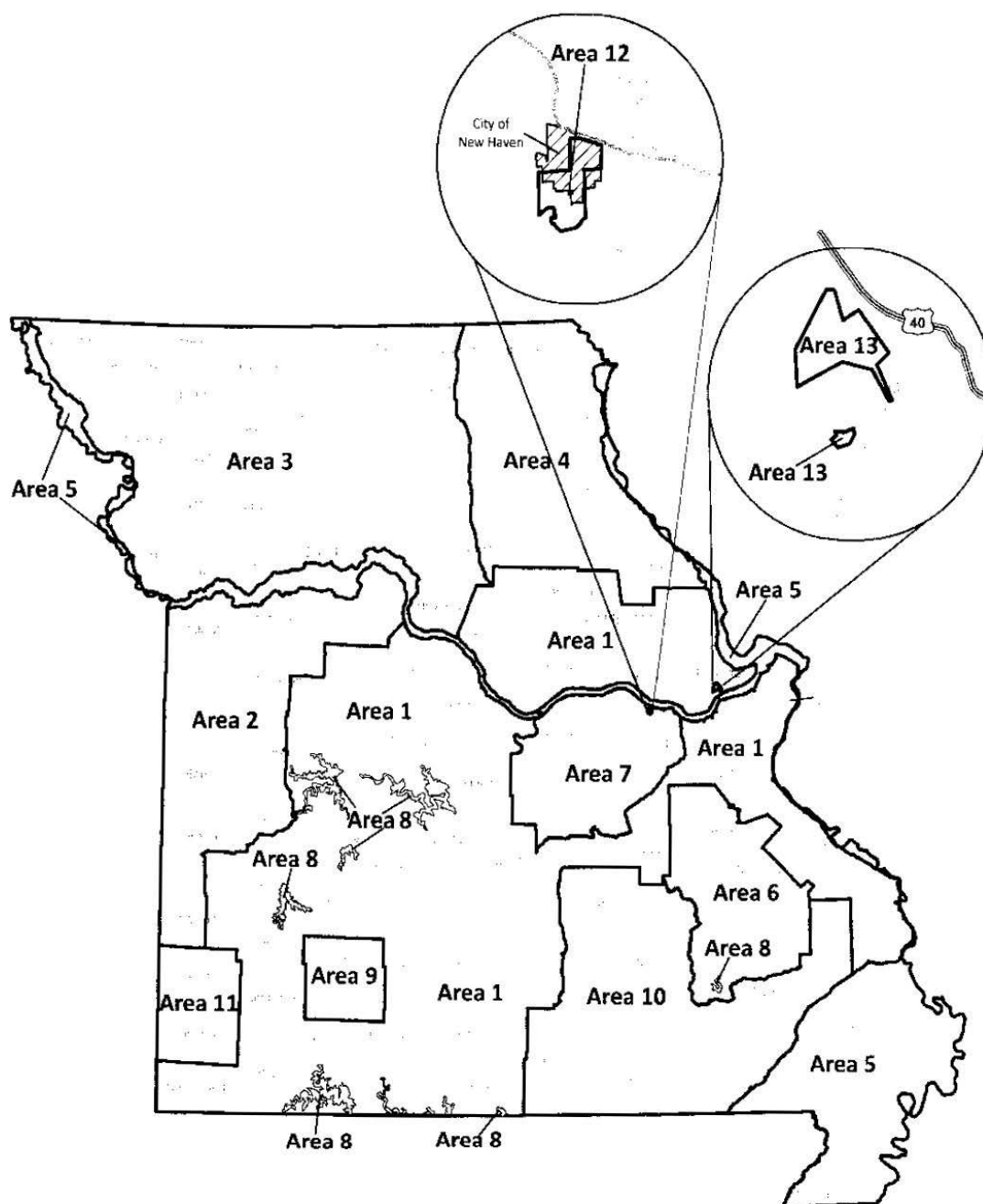


Figure 3.2 Drilling Areas 1, 7, 8, 9, and 11.

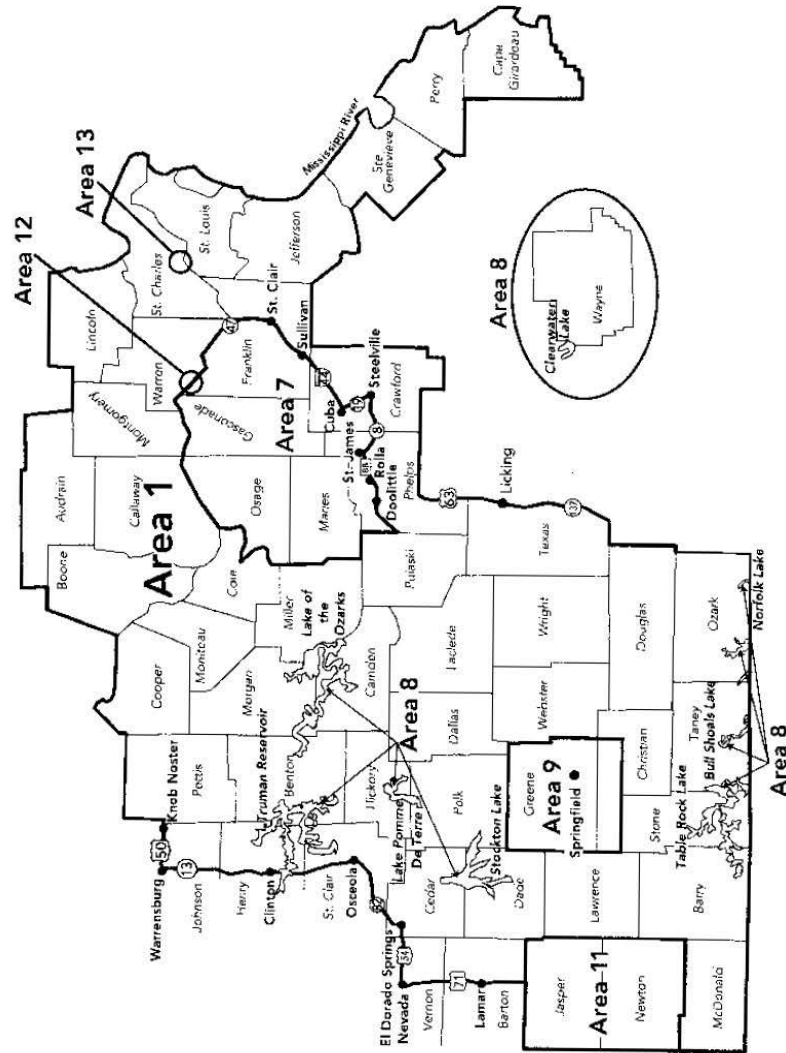






Figure 3.3 Drilling Area 2.

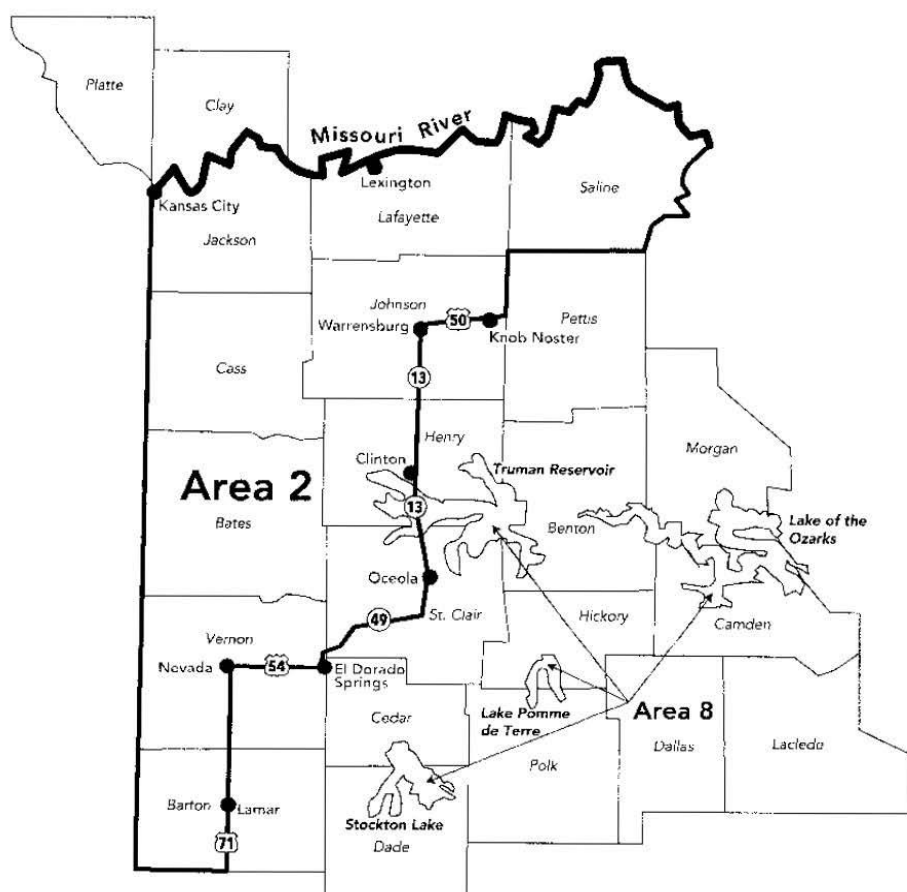


Figure 3.4 Drilling Area 3.



Figure 3.5 Drilling Area 4.





Figure 3.6 Drilling Area 5. This area includes the alluvial plains of the Missouri and Mississippi rivers.

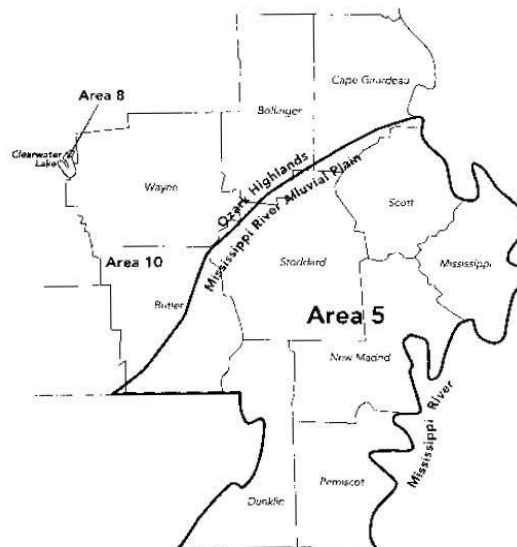


Figure 3.7 Drilling Area 6.



Figure 3.8 Drilling Area 10.

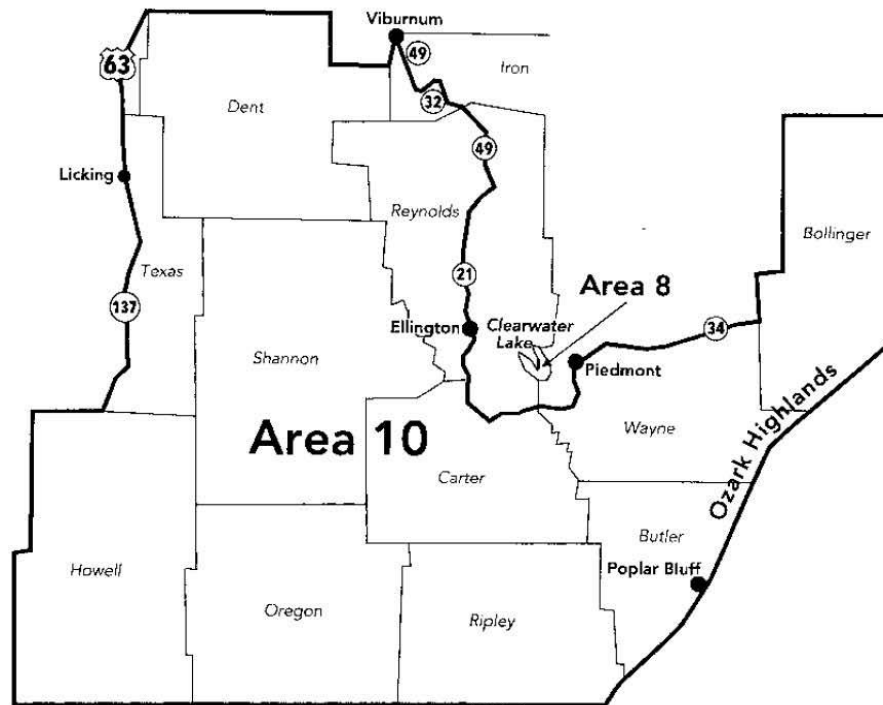




Figure 3.9 Drilling Area 12.

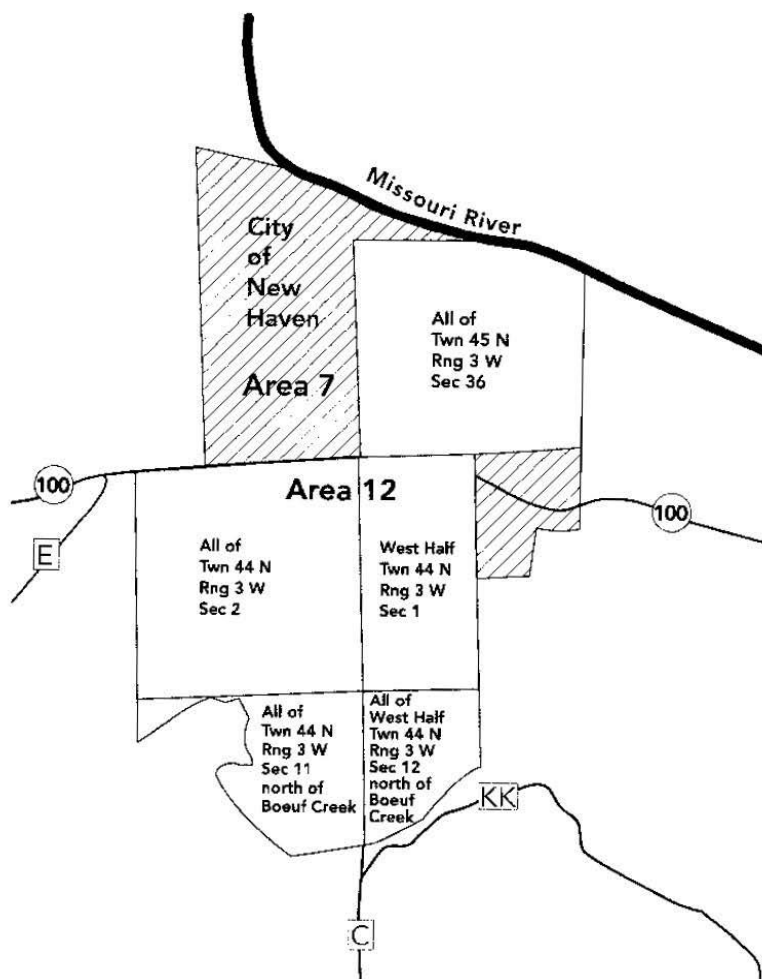
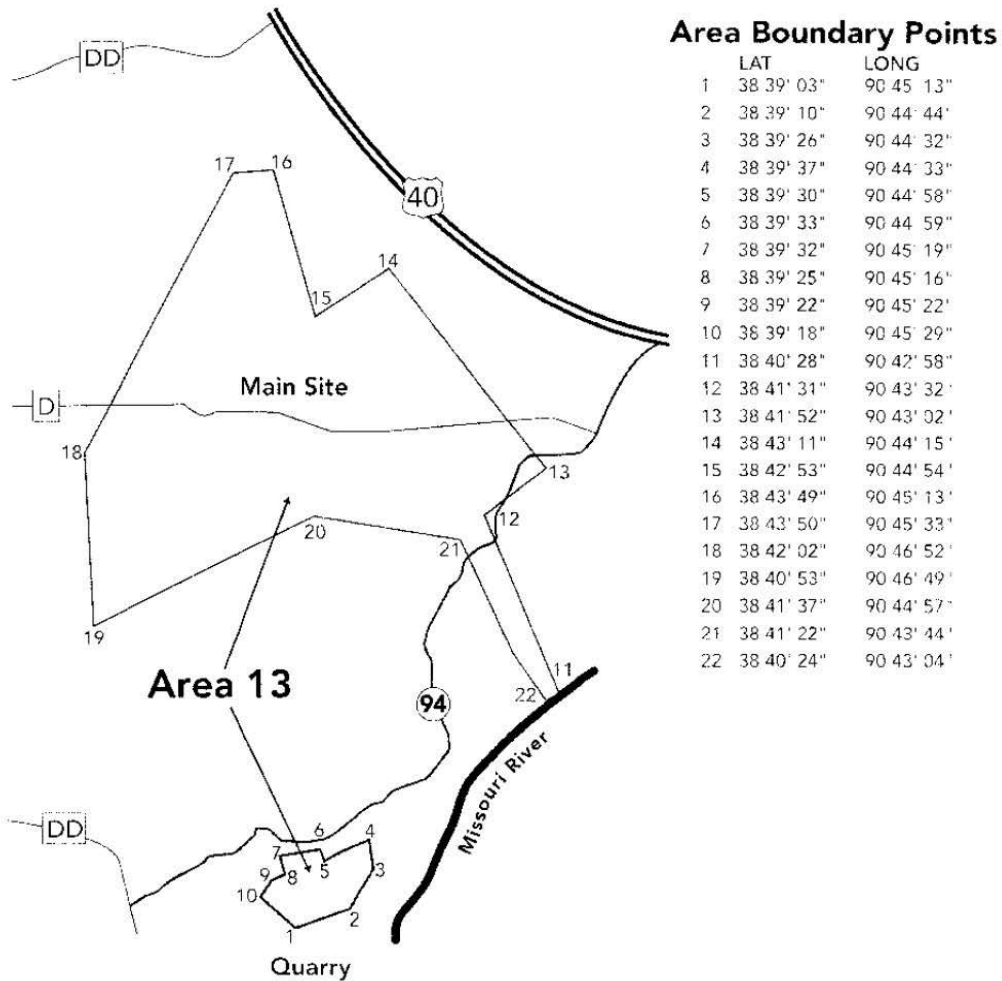


Figure 3.10 Drilling Area 13.







*AUTHORITY: sections 256.606 and 256.626, RSMo 2016.\* Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

#### **10 CSR 23-3.100 Sensitive Areas** (Rescinded February 28, 2019)

*AUTHORITY: sections 256.606 and 256.626, RSMo 2000. Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed April 23, 2001, effective Dec. 30, 2001. Emergency amendment filed March 21, 2005, effective April 1, 2005, expired Sept. 27, 2005. Amended: Filed Sept. 27, 2005, effective April 30, 2006. Amended: Filed Jan. 4, 2007, effective Aug. 30, 2007. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

#### **10 CSR 23-3.110 Plugging of Water Wells**

*PURPOSE: This rule establishes standards for plugging a water well.*

##### **(1) General Plugging Requirements for Water Wells.**

(A) Abandoned wells shall be plugged in accordance with these rules pursuant to sections 256.603(1) and 256.615, RSMo. If a well presents a contamination threat to groundwater, the department may order that the well be plugged.

(B) A permittee shall report to the department any unplugged abandoned wells existing on property where the permittee performed work under these rules.

(C) The well owner shall be responsible for plugging abandoned wells or causing the well to be plugged, except as follows:

1. When the permittee improperly locates, constructs, or completes a well, then the permittee is responsible for plugging the well unless the department has set a time-frame for remediation of the well;

2. A dry hole shall be plugged within thirty (30) days and a plugging registration record submitted. A certification record is

not required; or

3. Wells that produce saline water shall be plugged within thirty (30) days and a plugging registration record submitted. A certification record is not required.

##### **(2) General Plugging Methods.**

(A) A well that is to be plugged shall be disconnected from the water distribution system and the borehole sealed to prevent contaminants from entering an aquifer or prevent aquifer mixing.

(B) Contaminated wells shall be plugged by a permitted contractor. The department shall be consulted for plugging specifications. Groundwater sampling may be required.

(C) Wells contaminated by bacteria only may be plugged by the well owner.

(D) Wells that have an unknown casing depth shall be plugged full length with grout materials pursuant to 10 CSR 23-3.110(2)(E).

##### **(E) Grout Materials—**

1. Cement slurry;
2. Bentonite;
3. Bentonite slurry; or
4. Other approved grout.

##### **(F) Grout Placement Methods—**

1. Tremie;
2. Reverse tremie;
3. Gravity; or
4. Pressure.

(G) The top portion of the casing shall be removed and the excavated area filled by well type pursuant to 10 CSR 23-3.110(3).

(H) New or existing wells that have unusual conditions, includes but not limited to, contamination, a liner, a foreign object, or pump stuck in the borehole shall be plugged full length by a permitted contractor using cement, emplacing the cement grout by one (1) of the following methods: tremie, tremie pressure, or reverse tremie. Alternate plugging methods may be used upon advanced written approval by the department.

##### **(3) Domestic and Multifamily Water Well Plugging Requirements.**

(A) Hand dug and augered wells less than eighty feet (<80') in depth may be plugged by the landowner or a non-permitted person.

1. Remove the pump, pipe, debris, and surface covering.

2. Remove at a minimum the top one foot (1') of well lining unless the well is located in an agricultural setting where the removal of well lining shall be three feet (3') below ground surface. Lining may be composed of rock, brick, tile, tin, or clay pipe.

3. Disinfect the well. If water is in the well, add chlorine to the water pursuant to 10 CSR 23-3.050(7). If no water is in the well,

disinfect the fill material as it is placed into the well.

4. Fill the well with clean fill from total depth to one foot (1') from ground surface or if in an agricultural setting three feet (3') from ground surface.

5. Fill the remaining hole with clay or clay-rich soil. Soil should be mounded slightly to help offset settling.

##### **(B) Unconsolidated material wells.**

1. Remove the pump, pipe, and any debris from the well.

2. Remove the top two feet (2') of casing. If well is located in an agricultural setting remove the top three feet (3') of casing below ground surface. Excavate the area at least two feet (2') in diameter larger than the existing casing. If the well casing is surrounded by a concrete pad or asphalt, the casing may be cut off flush.

3. Disinfect the well. If water is in the well, add chlorine to the water pursuant to 10 CSR 23-3.050(7). If no water is in the well, disinfect the fill material as it is placed into the well.

4. Add clean fill.

A. Wells less than or equal to two hundred feet ( $\leq 200'$ ) total depth, add clean fill from total depth to approximately twenty feet (20') below ground surface.

B. Wells greater than two hundred feet (200') total depth, add clean fill from total depth to approximately fifty feet (50') below ground surface.

5. Add grout plug.

A. Wells less than or equal to two hundred feet ( $\leq 200'$ ) total depth, add grout from top of clean fill to one foot (1') below ground surface in yard or non-agricultural setting or three feet (3') below ground surface in an agricultural setting. Grout plug shall total twenty feet (20').

B. Wells greater than two hundred feet ( $> 200'$ ) total depth, add grout from top of fill to one foot (1') below ground surface in yard or non-agricultural setting or three feet (3') below ground surface in agricultural setting. Grout plug shall total fifty feet (50').

6. Add soil or clean fill.

A. Completely fill the excavated area above the grout plug with soil or clean fill.

B. If the well casing is surrounded by a concrete pad or asphalt, fill the top one foot (1') of casing above the grout plug with cement grout or quick-setting concrete.

7. If the well casing and screen are removed from the well, native material is allowed to collapse into the borehole; fill any remaining borehole with grout and add a minimum one foot (1') soil cap in a yard or non-agricultural setting or a three foot (3') soil cap in an agricultural setting.



## (C) Bedrock wells.

1. Remove the pump, pipe, liner, and debris from well. If any item is left in the well, see 10 CSR 23-3.110(2)(H) for plugging requirements.

2. Remove the top two feet (2') of casing. If well is located in an agricultural setting remove the top three feet (3') of casing below ground surface. Excavate the area at least two feet (2') in diameter larger than the existing casing. If the well casing is surrounded by a concrete pad or asphalt, the casing may be cut off flush. If the top two feet (2') of casing cannot be removed due to encountering bedrock or hard impervious material when digging around the casing, cut the casing flush with the top of bedrock or impervious material.

3. Disinfect the well. If water is in the well, add chlorine to the water pursuant to 10 CSR 23-3.050(7). If no water is in the well, disinfect the fill material as it is placed into the well.

4. Add clean fill. If the well is not filled full length with grout, then fill the well from total depth to fifty feet (50') below the bottom of the casing with clean fill.

5. Add a grout plug. Place a grout plug on top of clean fill from a point fifty feet (50') below the bottom of the casing completely filling the casing to one foot (1') below ground surface.

6. Add soil or clean fill. Fill the excavated area above the grout plug and with soil. Clean fill may be used to fill the excavated area above the grout plug if the well site is to be paved. If the well casing is surrounded by a concrete pad or asphalt, then fill the top one foot (1') of casing with cement grout or quick-setting concrete.

7. For a well with greater than eighty feet (>80') of casing the well may be plugged as follows.

A. Add clean fill. Fill the well with clean fill from total depth to fifty feet (50') below the bottom of the casing.

B. Add a lower grout plug. The lower grout plug shall extend from fifty feet (50') below the bottom of the casing to at least thirty feet (30') into the casing.

C. Add clean fill. Clean fill may be added on top of the lower grout plug and extend to fifty feet (50') below ground surface.

D. Add an upper grout plug. The upper grout plug shall extend from the top of clean fill (fifty feet (50') below ground surface) to one foot (1') below ground surface.

E. Add soil or clean fill pursuant to 10 CSR 23-3.110(3)(C)6.

8. For a well that has greater than one hundred feet (>100') of standing water, the

grout plug shall be emplaced by one (1) of the following methods: tremie, tremie pressure, reverse tremie, or gravity. If the gravity method is used only bentonite chips or pellets are allowed and shall be added slowly to avoid bridging. For reverse tremie, pour the cement slurry in one (1) continuous operation. For all methods, the tremie pipe shall be no greater than twenty feet (20') from the bottom of the well or the top of the fill material.

9. If the borehole does not have casing, the borehole may be filled with clean fill from total depth to fifty feet (50') below ground surface. From fifty feet (50') to within one foot (1') of ground surface, the borehole shall be filled with grout. Fill the top one foot (1') with soil or clean fill pursuant to 10 CSR 23-3.110(3)(C)6.

## (4) High Yield Well Plugging Requirements.

## (A) Bedrock Wells.

1. All high yield wells may be plugged using the following method without prior approval from the department.

A. Remove all materials from the well prior to plugging.

B. Cut the casing two feet (2') below ground surface or flush with bedrock if encountered. If the well is located in an agricultural setting remove the top three feet (3') of casing below ground surface.

C. Disinfect the well. If water is in the well, add chlorine to the water pursuant to 10 CSR 23-3.050(7).

D. Fill the well full length from total depth to the top of casing with cement slurry using one (1) of the tremie or reverse tremie methods.

E. Fill the remaining hole above the cut off casing with soil or fill material.

2. Other methods including the use of fill material may be used upon receiving advanced written approval by the department.

## (B) Unconsolidated wells.

1. Wells two hundred feet or less ( $\leq 200'$ ) in total depth may be plugged as follows:

A. Remove all materials prior to plugging;

B. Cut the casing two feet (2') below ground surface. If well is located in an agricultural setting remove the top three feet (3') of casing below ground surface;

C. Fill the well from total depth to twenty feet (20') from surface with disinfected clean fill;

D. Plug the upper twenty feet (20') with bentonite or cement grout; and

E. Fill the remaining hole above the cut off casing with soil or fill material.

2. Wells greater than two hundred feet

(>200') total depth may be plugged pursuant to 10 CSR 23-3.110(3)(B).

3. Other plugging materials and methods may be used upon receiving advanced written approval by the department.

(5) Inactive Water Wells may remain unplugged for a period no longer than five (5) years from the date the well became inactive provided the well owner obtains written approval from the department.

(A) Certified wells. Upon approval of inactive water well status, the pump must be removed and the wellhead provided with a permanent steel plate welded or a PVC cap glued. At the end of the five (5) year period, the well is considered abandoned and shall be plugged if not in service pursuant to 10 CSR 23-3.110.

(B) Noncertified wells. Prior to approval of inactive water well status, the following shall be completed:

1. The well owner or permitted pump installation contractor shall remove the pump;

2. Allow the department to inspect the well by use of a downhole camera;

3. Protect the wellhead by a permanent steel plate welded or a PVC cap glued; and

4. The well casing length shall meet the construction requirement for the drill area the well is located in.

(C) The department will deny the request for inactive status if any of the requirements listed under 10 CSR 23-3.110(4)(B) are not met, the well does not meet minimum construction standards, or the well is found to be in a state of disrepair.

1. The well owner may reconstruct the well to meet minimum construction standards. Once the reconstruction report is approved, the well owner may reapply for inactive well status.

2. If the well is not operational at the end of the five (5) year period, the well is considered abandoned and shall be plugged if not in service pursuant to 10 CSR 23-3.110.

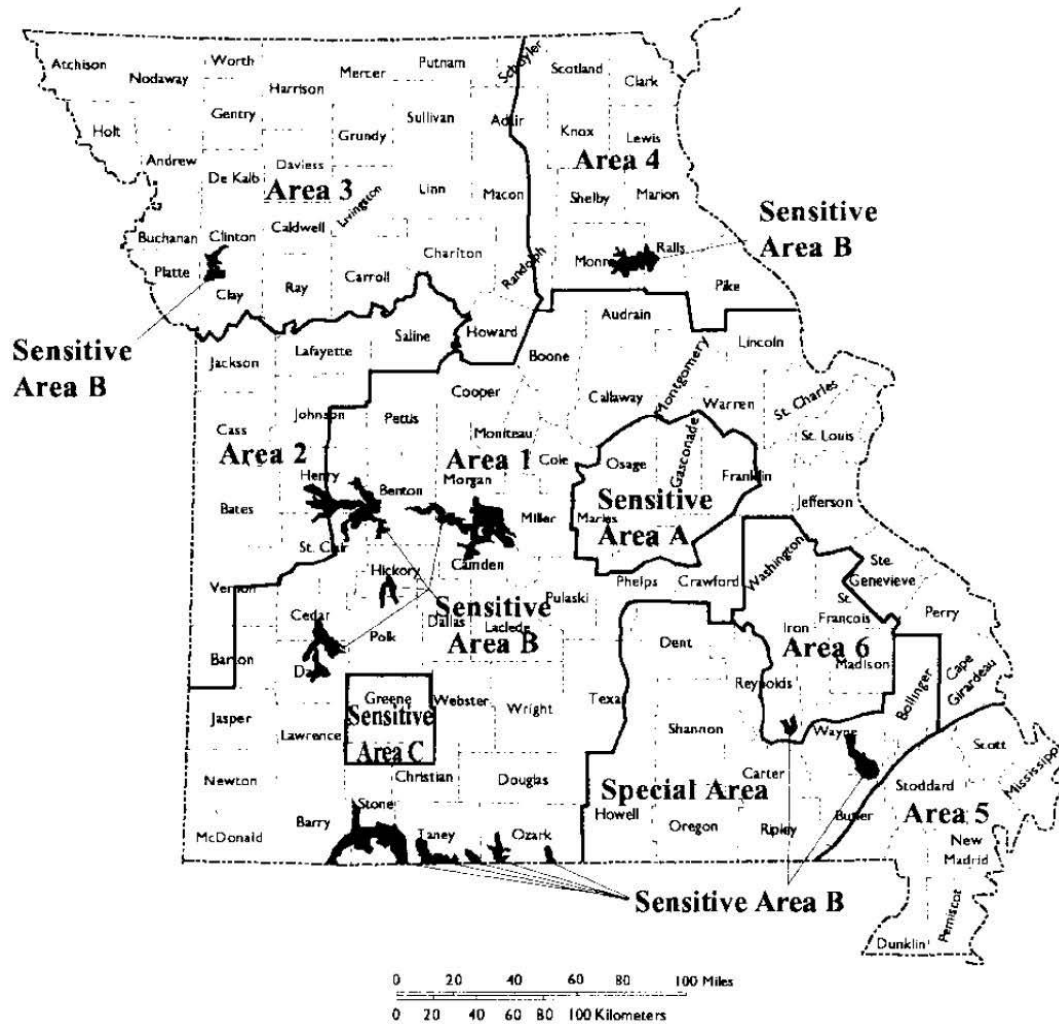


Figure 1. Map showing drilling areas for private well construction regulations. Areas are enlarged in maps on following pages.

## Area 2

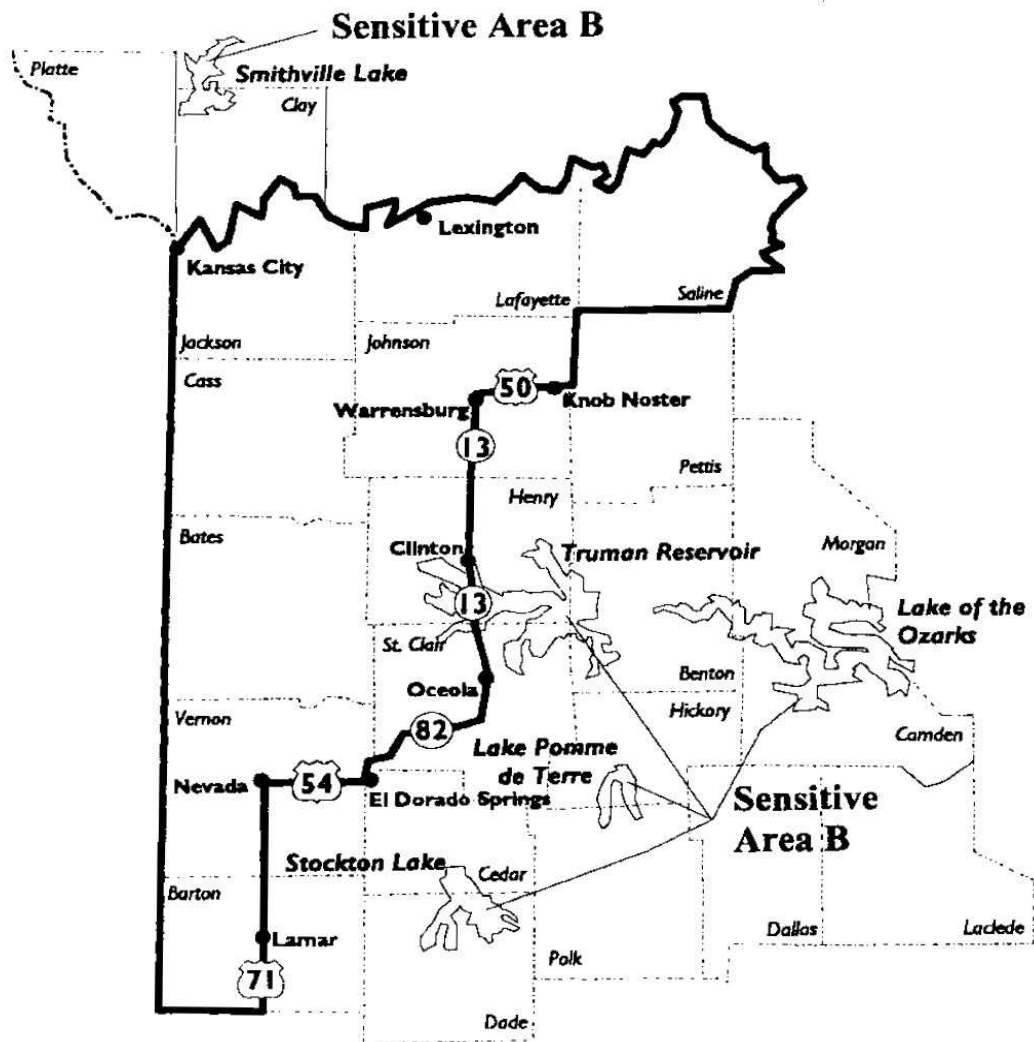
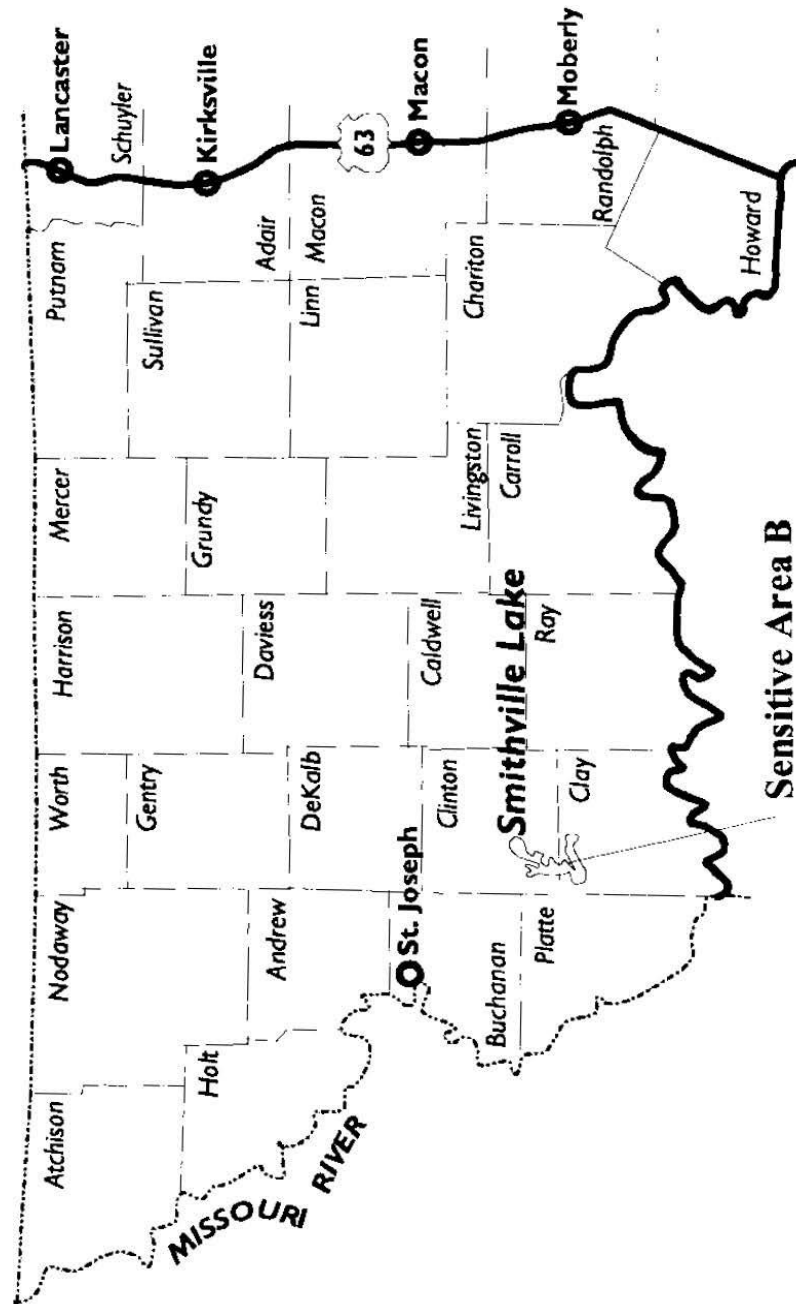


Figure 2. Enlargement of Area 2 and Sensitive Area B map.



## Area 3



Sensitive Area B

Figure 3. Enlargement of Area 3 and part of Sensitive Area B map.

## Area 4

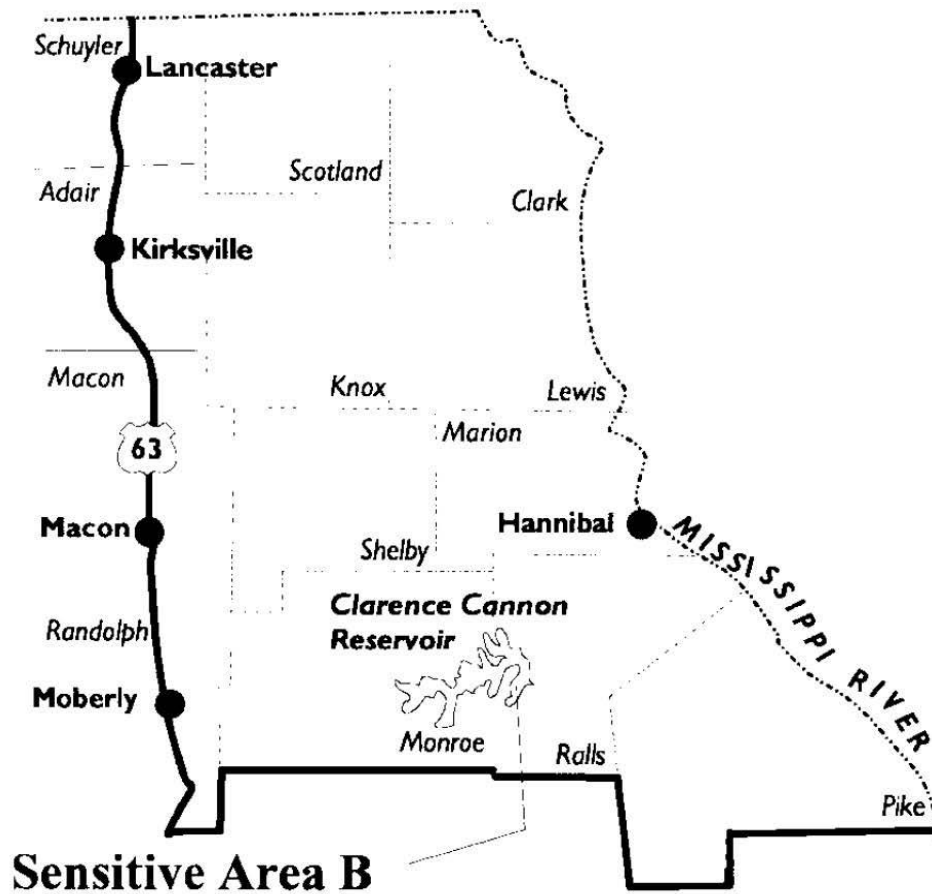


Figure 4. Enlargement of Area 4 and part of Sensitive Area B map.





## Area 5

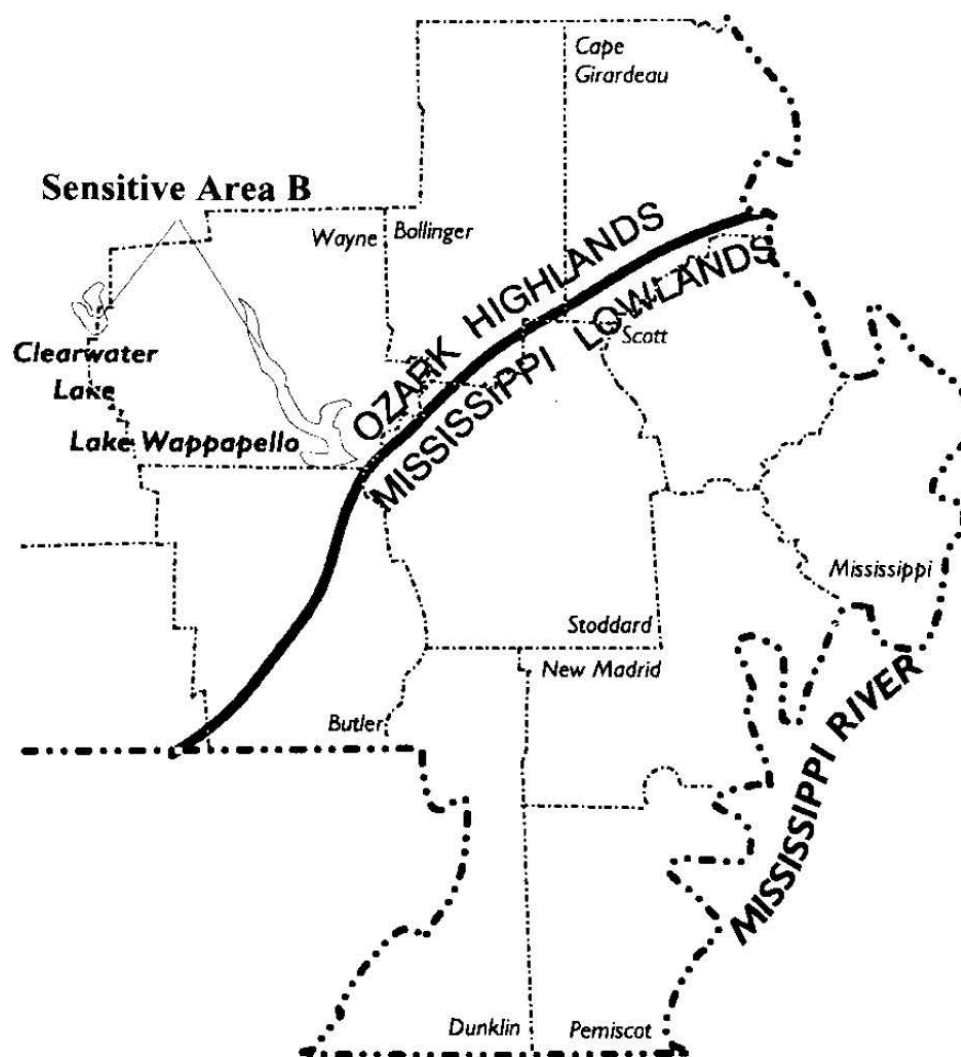


Figure 5. Enlargement of Area 5 and part of Sensitive Area B map.

## Area 6

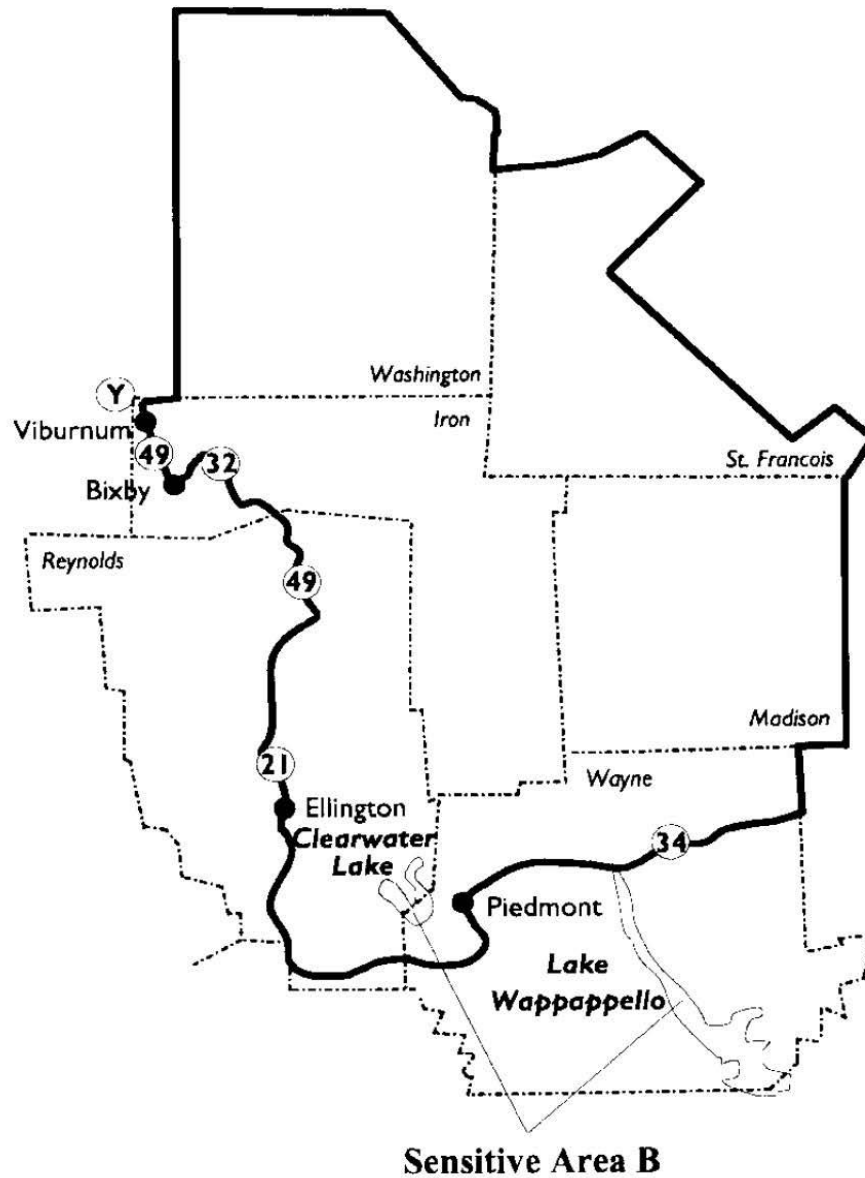


Figure 6. Enlargement of Area 6 and part of Sensitive Area B map.



## Special Area

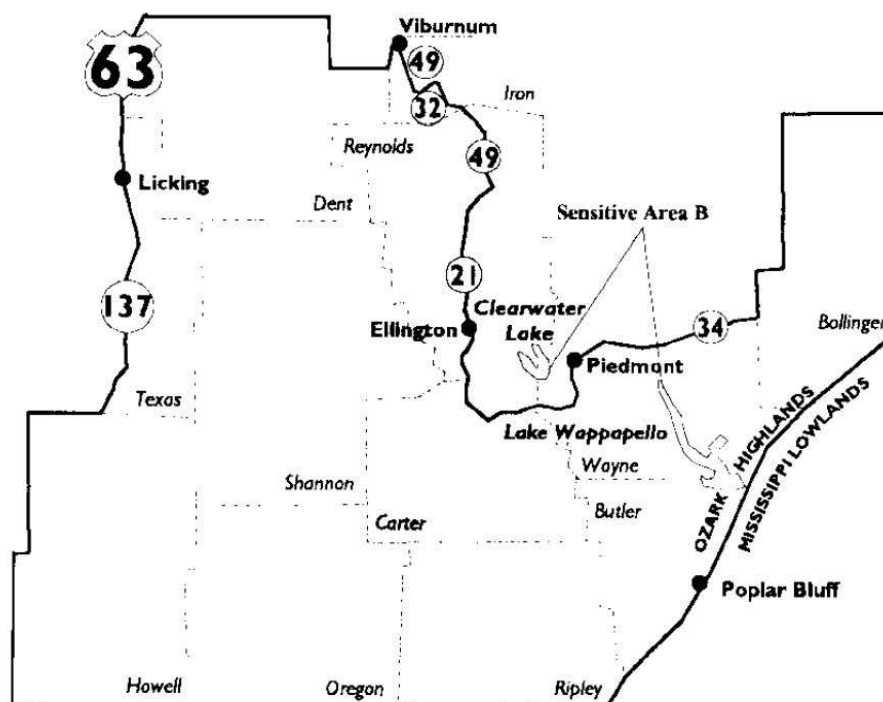


Figure 7. Enlargement of Special Area and part of Sensitive Area B map.

# Area 1 and Sensitive Areas A, B, and C

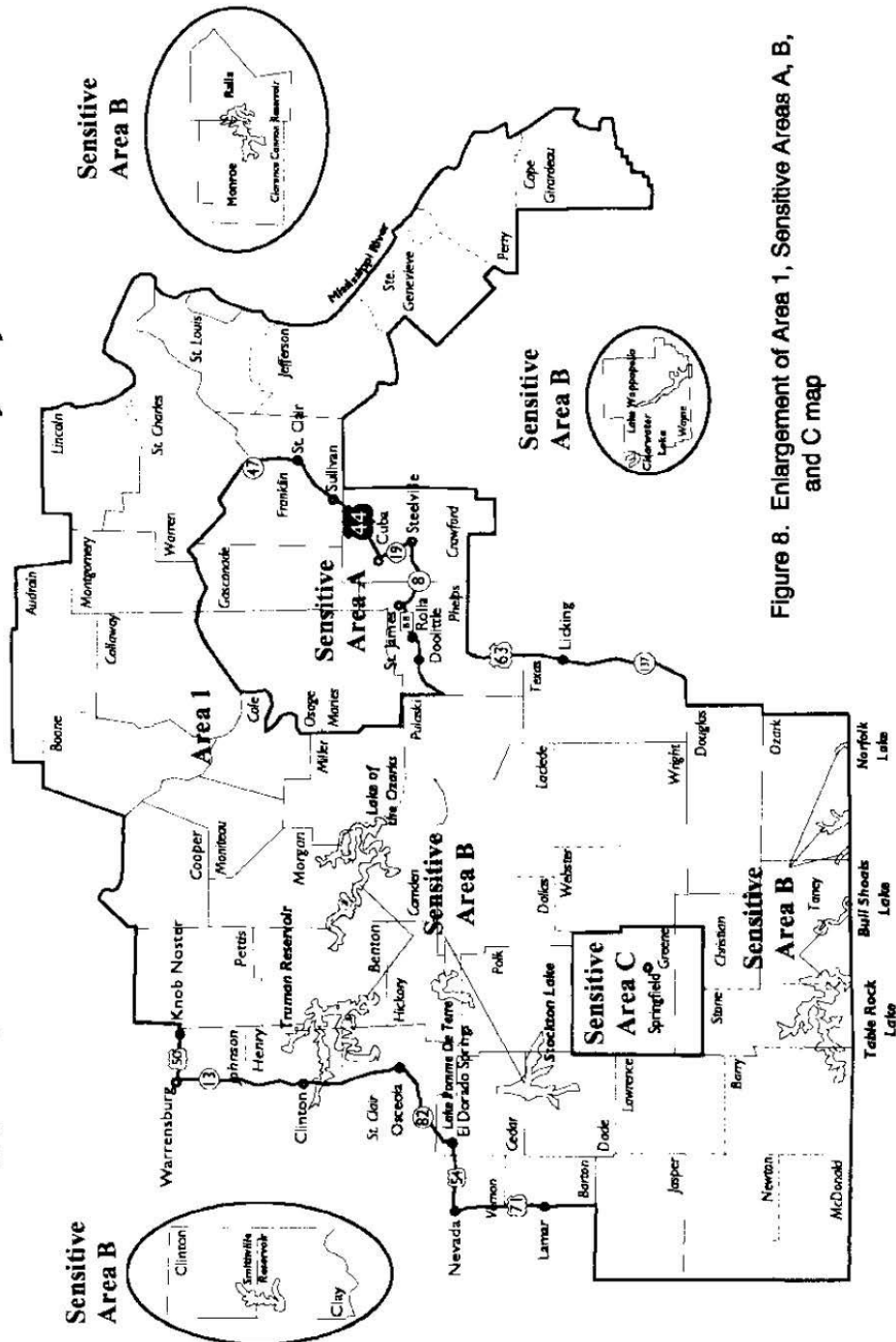


Figure 8. Enlargement of Area 1, Sensitive Areas A, B, and C map



*AUTHORITY:* sections 256.606, 256.614, 256.615, and 256.626, RSMo 2016.\* *This rule was previously filed as 10 CSR 23-3.020(3)-(9). Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.614, RSMo 1985, amended 1991; 256.615, RSMo 1991; and 256.626, RSMo 1985, amended 1991.*



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**Rules of**  
**Department of Natural Resources**  
**Division 23—Well Installation**  
**Chapter 4—Monitoring Well Construction Code**

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**Title 10—DEPARTMENT OF  
NATURAL RESOURCES  
Division 23—Well Installation  
Chapter 4—Monitoring Well  
Construction Code**

**10 CSR 23-4.010 Definitions**  
(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.603, 256.606, and 256.626, RSMo 2000. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Nov. 18, 2010, effective July 30, 2011. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

**10 CSR 23-4.020 Certification and Registration for Monitoring Wells**  
(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.606, 256.614, and 256.626, RSMo 2000. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Nov. 18, 2010, effective July 30, 2011. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

**10 CSR 23-4.030 Location of Wells**  
(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.606 and 256.626, RSMo 2000. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 18, 2010, effective July 30, 2011. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

**10 CSR 23-4.040 Drilling Methods for Monitoring Wells**  
(Rescinded July 30, 2011)

*AUTHORITY:* sections 256.606 and 256.626, RSMo Supp. 1991. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Rescinded: Filed Nov. 18, 2010, effective July 30, 2011.

**10 CSR 23-4.050 General Protection of Groundwater Quality and Resources**

*PURPOSE:* This rule prevents the use of monitoring wells for any purpose other than the purpose for which they were designed and allows certain modifications to the application of these rules.

(1) Monitoring wells shall not be converted to any other type of well unless advanced written approval is obtained from the department.

(2) Monitoring wells shall be constructed so that aquifer mixing does not occur and may not be screened through the soil-bedrock horizon unless advanced written approval is obtained from the department. Drilling water shall be of potable quality.

*AUTHORITY:* sections 256.606 and 256.626, RSMo 2016.\* Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Nov. 18, 2010, effective July 30, 2011. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.

**10 CSR 23-4.060 Construction Standards for Monitoring Wells**

*PURPOSE:* This rule describes the minimum construction standards for monitoring wells.

(1) Riser Pipe and Screen Material.

(A) Chemical Compatibility. If used in a monitoring well, the riser pipe and screen material selected shall resist chemical corrosion for the life of the proposed monitoring program and be new and free from contaminants that would adversely affect the quality of the groundwater.

(B) Riser Pipe and Screen Materials. The following types of riser pipe and screen materials may be used:

1. Thermoplastic materials, including polyvinyl chloride (PVC) and acrylonitrilebutadiene-styrene (ABS);

2. Metallic materials, including carbon steel, low-carbon steel, galvanized steel, and stainless steel (304 and 316);

3. Fluoropolymer materials, including polytetrafluoroethylene (PTFE), tetrafluoroethylene (TFE), fluorinated ethylene propylene (FEP), perfluoroalkoxy (PFA), polyvinylidene fluoride (PVDF), and polyamides (such as Nylon); and

4. Other types of riser pipe and screen may be used upon advanced written approval from the department.

5. Industry standard mesh material or pre-manufactured slotted screen is the only approved material for screening; hand-cut solid wall pipe is not allowed.

(C) Thermoplastic and fluoropolymer riser pipe shall—

1. Be new and meet ASTM standards;

2. Be a minimum diameter of two inches (2") except that direct-push wells may have riser pipe with a minimum nominal diameter of three-quarters of an inch (3/4");

3. Be a minimum of Schedule 40 for wells one hundred feet or less ( $\leq 100'$ ) and a minimum of Schedule 80 for wells greater than one hundred feet ( $> 100'$ ). Gas-migration wells using a soil gas implant and tubing are exempt from this requirement; and

4. Be joined to screen by a watertight mechanical type joint.

(D) Metallic riser pipe shall—

1. Be a minimum diameter of two inches (2") except that direct-push wells may have riser pipe and screen with a minimum diameter of three-quarters of an inch (3/4").

2. Have an equivalent wall thickness—

A. For carbon, low-carbon, and galvanized steel not less than Schedule 40;

B. For stainless steel not less than Schedule 5; and

C. For joint wall thickness shall not less than Schedule 40; and

3. Be joined by a watertight mechanical joint or welded.

(2) Casing Material.

(A) Casing Materials. The following types of casing shall be used:

1. Thermoplastic materials;

2. Fluoropolymer materials;

3. Metallic materials, including steel casing material that meets the minimum specifications pursuant to 10 CSR 23-3.030(1). The joining of two (2) dissimilar metals is not allowed; or

4. Other types of casing may be used upon advanced written approval from the department.

(B) Casing diameter shall be a minimum of four inches (4") larger than the outside diameter of the riser pipe being installed.

(C) Casing borehole diameter shall be a minimum of four inches (4") larger in diameter than the outside diameter of the casing.

(D) The casing, if installed, shall be grouted full-length with high solids bentonite slurry or cement slurry pursuant to 10 CSR 23-4.060(9) using the tremie method or one (1) of the pressure grouting methods pursuant to 10 CSR 23-3.030(1)(B). Extend the annular



seal for the riser from a point at least two feet (2') below the base of the casing up to the base of the surface completion.

(3) Monitoring well boreholes shall—

- (A) Be clean and free of obstructions;
- (B) Have a diameter that is at least four inches (4") larger than the outside diameter of the riser pipe and screen;
- (C) For gas-migration type wells using soil vapor implants, be a minimum of one inch (1") in diameter and be exempt from these borehole standards if properly plugged within thirty (30) days of completion; and
- (D) For direct-push wells, be a minimum of three and one-quarter inches (3.25") in diameter and be exempt from these borehole standards if properly plugged within thirty (30) days of completion.

(4) Open-hole completions may be allowed upon advanced written approval by the department. If approved, the open-hole portion shall be in competent, consolidated bedrock, with the casing extending from the surface to the minimum total depth and minimum depth into bedrock pursuant to 10 CSR 23-3.090 for a domestic well at that location. The casing shall be grouted full-length using methods and materials pursuant to 10 CSR 23-4.060(2)(E).

(5) Installation of Well Screen and Riser Assembly. The well screen and riser assembly shall be centered in the borehole before the installation of the filter pack, unless a prepack filter is used. Extend the riser pipe from the well screen into the surface completion. Monitoring wells greater than fifty feet (>50') in depth shall have centralizers installed at the base of the well screen and at the top of the filter pack. A centralizer is not necessary for direct-push wells or wells constructed through hollow-stem augers.

(6) Primary Filter Pack. All monitoring wells shall have a primary filter pack installed using one (1) of the following methods. Other methods may be used upon advanced written approval by the department.

(A) Artificially Constructed Filter Pack Placement. Place the filter pack material evenly around the well screen via a tremie pipe. The tremie pipe must be placed within five feet (5') of the bottom of the well screen and the filter pack material poured into the tremie pipe while the pipe is slowly removed. Fill the borehole with filter pack material to within one to five feet (1'-5') above the well screen. If the well is drilled using the hollow stem auger method, the filter pack material may be poured through the hollow stem auger

as it is removed from the borehole. Prepacked filter pack assemblies may be used in lieu of artificially constructed filter pack placement.

(B) Naturally Developed Filter Pack Placement. The existing geologic material may be allowed to collapse around the well screen provided the well can be developed.

(C) The primary filter pack on shallow monitoring wells shall extend a minimum of six inches (6") above the top of the well screen.

(D) Soil vapor implants shall have a minimum primary filter pack of six inches (6") above and below each implant.

(7) Secondary Filter Pack. All monitoring wells shall have a secondary filter pack unless non-slurry bentonite is used as a bentonite seal or annular seal. The secondary filter pack shall extend from one foot to two feet (1'-2') above the primary filter pack and consist of one foot to two feet (1'-2') of clean fine sand.

(8) Bentonite Seal. A bentonite seal of two feet (2') or greater is required if the annular seal is composed of slurry grout material and a secondary filter pack is not used.

(A) Placement of the Bentonite Seal in the Saturated Zone. When the bentonite seal is to be emplaced in the saturated zone, only bentonite chips or pellets may be used. To avoid flash swelling and bridging, the fine bentonite material, which may develop during transport, shall not be introduced into the well bore. Place the bentonite chips evenly around the riser pipe.

(B) Placement of the Bentonite Seal in the Unsaturated Zone. When the top of the secondary filter pack is in the unsaturated zone, bentonite chips, pellets, or granules may be used provided the bentonite is hydrated in place with potable water. Bentonite slurry may be used to fill the annular space from the top of the secondary filter pack, if present, to the surface seal via a tremie pipe. If the total depth of the slurry being placed exceeds five feet (5'), use a side discharge to limit disruption of the filter packs.

(9) Installation of the Annular Seal. The annular seal must extend from the secondary filter pack or bentonite seal to the base of the surface completion. The combined annular seal and bentonite seal (if a bentonite seal is utilized) must be at least two feet (2') thick unless monitoring for shallow contaminants. Monitoring wells constructed for shallow monitoring must have a minimum combined annular seal and bentonite seal (if a bentonite seal is used) of at least one foot (1'). The following grout types are permitted in monitor-

ing wells:

(A) Bentonite Slurry-Grout. High solids sodium bentonite slurry, at least twenty to thirty percent (20%-30%) by weight solids, must be tremie grouted from the bottom to the top of the annular space in one (1) continual operation;

(B) Nonslurry Bentonite. Chipped or pelletized varieties that are designed to fall through standing water may be used when sealing the annulus of a well that is below the saturated zone. Granulated and powdered bentonite must never be poured through standing water because they will flash swell and bridge off before getting to the bottom of the annular space. Bentonite chips or pellets may be used to seal portions of the annular space that are in the unsaturated zone. Granulated and powdered varieties are not permitted to be used in the unsaturated zone unless they are used to create a slurry, due to their flash swelling properties which would prevent hydration of the complete column of bentonite. When using bentonite chips or pellets in the unsaturated zone, it must be hydrated after each three feet (3') interval has been emplaced. To properly hydrate the bentonite, a minimum of three (3) times as much water as bentonite must be used. Water used must be of potable quality;

(C) Cement Slurry.

1. Cement slurry may only be used if additives are incorporated to minimize shrinkage.

A. The powdered bentonite additive must be thoroughly mixed with the water before it is added to the cement. Powdered bentonite from two percent to six percent (2%-6%) by weight must be added.

B. Other shrinkage reducing additives may be used provided advanced written approval is obtained from the department;

2. The water used to mix cement slurry must be of potable quality; and

3. Cement slurry must be emplaced in the annulus via a tremie pipe placed to the bottom of the annular space. The tremie pipe must have a side discharge which directs the grout away from the bentonite seal, reducing the potential for infiltration. The grouting of the annular space must be completed in one (1) continual operation, lifting the tremie pipe as the space fills. A staged grouting procedure may be used provided advanced written approval is obtained from the department; or

(D) Other types of grout may be used provided advanced written approval is obtained from the department.

(10) Surface completion on all monitoring wells is required.



(A) Above-Ground Completions. Above-ground completions must meet the following standards:

1. The protective casing must extend from at least one and one-half feet (1 1/2') above the finished grade of the ground surface to a point at least two feet (2') below the finished grade, except as stated in 10 CSR 23-4.060(10)(B) of this rule for flush-mount completions. The above-ground completion must be placed in a hole that is at least eight inches (8") in diameter larger than the above-ground completion size. Protective posts are required for above-ground completed monitoring wells in traffic areas. The protective casing must be centered in this hole and concrete poured around the casing to secure it. Cement or bentonite slurry is not allowed. All water must be removed from the enlarged hole before concrete is added. The surface of the concrete must slope away from the protective casing so that pooling of surface water does not occur;

2. A weep hole or alternate method must be employed to ensure water does not accumulate inside the protective casing to the point that the top of the riser is submerged; and

3. A locking well cap and a suitable lock must be attached to the top of the above-ground completion. The riser pipe must be sealed with a watertight cap and must extend at least two feet (2') above the finished surface grade in flood prone areas.

(B) Flush-Mount Well Completions. The flush-mount assembly must be at least eight inches (8") in length and have a tamper-resistant watertight lid. The riser pipe must be sealed with a watertight cap. The flush-mount surface completion must be set into a hole that is at least eight inches (8") in diameter larger than the diameter of the flush-mount assembly and set in concrete. If the monitoring well is being placed through asphalt or concrete, a hole that is at least four inches (4") in diameter larger than the diameter of the flush-mount assembly must be constructed. The flush mount must then be set in concrete. Cement or bentonite slurry is not allowed.

(C) All monitoring wells must be uniquely identified at the surface completion.

(11) Alternate monitoring well construction procedures, methods, or technologies may be used provided advanced written approval is obtained from the department.

(12) The installation and use of sampling, development, maintenance, or testing devices and equipment in monitoring wells is not regulated except that the installation of a pumping system in wells used for remediation or

clean-up must be performed by a non-restricted pump installation contractor.

(13) Nested well construction may be allowed upon advanced written approval by the department. Gas-migration wells constructed using soil vapor implants shall meet minimum primary filter pack requirements pursuant to 10 CSR 23-4.060(6), have a minimum bentonite seal of one foot (1') placed between each primary filter pack, and have a minimum of one and one-half feet (1.5') of bentonite seal placed between the uppermost primary filter pack and the base of the surface completion.

*AUTHORITY:* sections 256.606 and 256.626, RSMo 2016. \* Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Nov. 18, 2010, effective July 30, 2011. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.

#### **10 CSR 23-4.070 Monitoring Well Development** (Rescinded July 30, 2011)

*AUTHORITY:* sections 256.606, 256.626, and 256.637, RSMo 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Rescinded: Filed Nov. 18, 2010, effective July 30, 2011.

#### **10 CSR 23-4.080 Plugging of Monitoring Wells**

*PURPOSE:* This rule sets standards for the plugging of monitoring wells.

(1) When plugging a monitoring well, the following minimum requirements shall be met:

(A) Remove all pumps, sampling equipment, debris, or other substances;

(B) Remove the surface completion from the borehole ensuring that the grout seal is not disturbed. Cut off riser pipe and/or casing two feet (2') below ground surface;

(C) Fill the well from bottom to within one foot (1') of ground surface with grout pursuant to 10 CSR 23-4.060(9);

(D) After the grout is fully cured, check for settlement and top off if necessary. Fill

remaining hole with soil or pave.

(E) Flush mount completions in paved areas may be left in place and filled with asphalt or concrete;

(F) A monitoring well may be completely excavated as opposed to being plugged with grout. If the well is over drilled, the borehole shall be completely filled with grout pursuant to 10 CSR 23-4.060(9); and

(G) A non-restricted monitoring well installation contractor must be on site at all times during the excavation and plugging operations.

(2) Temporary monitoring wells ten feet (10') or greater in depth must be plugged by removing any temporary pipe and filling the well from total depth to two feet (2') from the ground surface with approved grout, with the remainder of the well filled with compacted uncontaminated native material or grout. Temporary monitoring wells shall be plugged within thirty (30) days of the date of completion.

*AUTHORITY:* sections 256.606, 256.615, and 256.623, RSMo 2016. \* Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Nov. 18, 2010, effective July 30, 2011. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.606, RSMo 1991; 256.615, RSMo 1991; and 256.623, RSMo 1985, amended 1991.



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**Rules of**  
**Department of Natural Resources**  
**Division 23—Well Installation**  
**Chapter 5—Heat Pump Construction Code**

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**Title 10—DEPARTMENT OF  
NATURAL RESOURCES  
Division 23—Well Installation  
Chapter 5—Heat Pump Construction  
Code**

**10 CSR 23-5.010 Definitions**  
(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.603, 256.606, and 256.626, RSMo 2000. *Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.*

**10 CSR 23-5.020 Certification and Registration of Heat Pump Systems**  
(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.606, 256.623, and 256.626, RSMo 2000. *Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.*

**10 CSR 23-5.030 General Protection of Groundwater Quality and Resources**

*PURPOSE:* This rule prevents the use of heat pump wells for any other purpose.

(1) Heat pump wells shall not be converted to any other type of well unless advanced written approval is obtained from the department.

(2) On open-loop systems that utilize groundwater wells, it is the responsibility of the water well installation contractor to ensure that the integrity of the annular seal remains viable for three (3) years after the date of certification unless it can be shown that the well seal has been damaged by other persons.

*AUTHORITY:* sections 256.606 and 256.626, RSMo 2016.\* *Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.

**10 CSR 23-5.040 Location of Heat Pump Wells**

*PURPOSE:* This rule sets standards for the placement of heat pump wells.

(1) A vertical heat pump well shall be located on a site which has good surface drainage and prevents the accumulation of water within ten feet (10') of the well and any buried pipes.

(2) Distances from pollution or contamination sources. A vertical heat pump well shall be at least—

(A) Three hundred feet (300') from a storage area for commercial fertilizers or chemicals, landfill, lagoon, or above-ground or underground storage tank for petroleum, petroleum products or chemicals.

(B) One hundred feet (100') from a below-grade manure storage area, cesspool, lagoon, unplugged abandoned well, subsurface disposal field (lateral field), grave, building or yard used for livestock or poultry, privy, or other contaminants that may drain into the ground.

(C) Fifty feet (50') from an existing operating well, septic tank, buried sanitary sewer, rim of a sinkhole, a pit or unfilled space below ground surface, a sump, except that a closed-loop heat pump well may be drilled closer than fifty feet (50') to a basement or another heat pump well.

(3) Any heat pump well that encounters oil and/or gas must have a grout plug from fifty feet (50') below the oil and/or gas bearing zone to fifty feet (50') above the oil and/or gas bearing zone. The grout plug must be composed of neat cement grout with a two percent–six percent (2%–6%) bentonite additive and be placed via tremie. The well must be grouted pursuant to 10 CSR 23-5.050(7)(A), from the bottom of the neat cement grout plug to total depth and from the top of the neat cement grout plug to the surface. If the well terminates in the oil and/or gas bearing zone, a grout plug composed of neat cement with a two percent–six percent (2%–6%) bentonite additive and placed via tremie must be placed from total depth to fifty feet (50') above the oil and/or gas bearing zone. The well must be grouted pursuant to 10 CSR 23-5.050(7)(A), from the top of the neat cement grout plug to the surface.

*AUTHORITY:* sections 256.606 and 256.626, RSMo 2016.\* *Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amend-*

*ed: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.

**10 CSR 23-5.050 Construction Standards for Closed-Loop Heat Pump Wells**

*PURPOSE:* This rule describes the minimum standards for a properly constructed closed-loop heat pump well.

(1) Casing, when used, shall follow the minimum standards pursuant to 10 CSR 23-3.030(1)(A) and be grouted full-length.

(2) Heat Pump Loop Material. In a closed-loop heat pump well, the material used to make up the heat-exchange loop that is placed in the borehole or trench must be composed of high density polyethylene or polybutylene pipe and must be installed and grouted without delay upon completion of drilling each well.

(A) High Density Polyethylene Pipe. This pipe must be manufactured in accordance with dimensional specifications of ASTM D-2513 or ASTM F-714 and must have a minimum cell classification of PE345434C or PE355434C when tested under ASTM D-3350 to be acceptable for use in closed-loop heat pump systems.

(B) Polybutylene Pipe. This pipe must be manufactured in accordance with ASTM D-2581. The pipe material must be—

1. Either Class B (general purpose and dielectric, in colors) or Class C (weather resistant, black in color containing not less than two percent (2%) carbon black);

2. Type II (density, ninety-one thousandths to ninety-two thousandths (0.091–0.092) grams per centimeter (g/cm));

3. Grade 1 (flow rate twenty-five thousandths to seventy-five thousandths (0.025–0.075) gallons per ten (10) minutes (g/10 min)).

(C) Other pipe may be used upon advanced written approval by the department.

(3) Connecting Closed-Loop Pipe. Polyethylene and polybutylene pipe must be thermally fused according to the pipe manufacturer's specifications and must not leak after assembly.

(A) Other connection methods may be used upon advanced written approval by the department.

(4) Heat Transfer Fluid. The fluid used inside the closed-loop assembly must meet





the following standards:

(A) Heat transfer fluids must be composed of—

1. Inhibited glycol;
2. Methanol;
3. Water;
4. Ethanol; or

5. Other fluids may be used upon advanced written approval by the department.

(B) The fluid as it is used in a diluted state in the closed-loop must have the following properties:

1. Be ninety percent (90%) biodegradable;
2. Demonstrate low corrosion to all materials common to ground source heat pump systems;
3. Be homogeneous, uniform in color, free from lumps, skins, and foreign material that would be detrimental to fluid usage;
4. Not have a flash point lower than ninety degrees Celsius (90°C);
5. Not have a five- (5-) day biological oxygen demand (BOD) at ten degrees Celsius (10°C) that exceeds two-tenths (0.2) gram oxygen per gram nor be less than one-tenth (0.1) gram oxygen per gram;
6. Have a toxicity that is less than the lethal dose (LD) of fifty (50) oral-rats of five (5) grams per kilogram; and
7. Show neither separation, or increase in turbidity, from exposure to heat or cold; and

(C) While this rule attempts to define antifreeze fluids that will protect the environment, it is the responsibility of the permittee to take necessary precautions to ensure groundwater protection.

(5) Borehole Size. The hole size for heat pump wells that are grouted full-length with high solids bentonite slurry (see 10 CSR 23-5.050(9)(A)) must be of sufficient size to allow placement of the pipe and placement of a tremie to emplace the high solids bentonite slurry grout. The slurry must be pumped via tremie to fill the hole and surround all pipes. There must be at least one-half inch (1/2") between the hole and all pipes. If full-length high solids bentonite slurry is not used, then the following hole sizes are required:

(A) At least a six-inch (6") borehole when the loop pipe is one and one-quarter inch (1 1/4") or greater in diameter;

(B) At least a five-inch (5") borehole when the loop pipe is less than one and one-quarter inch (1 1/4") in diameter.

(6) Borehole Depth. Closed-loop heat pump wells must not be deeper than five hundred feet (500'). Total depth of a new heat pump well in Drilling Area 12 (formerly Special

Area 3) and Drilling Area 13 (formerly Special Area 4) shall be determined in advance of drilling by the department.

(7) Grouting Depth of Vertical Heat Pump Wells. Grouting the annulus of a heat pump well must be completed immediately after the well is drilled due to cave-in potential in the uncased hole.

(A) Vertical heat pump wells require the annular space between the loop material, borehole, and/or casing to be grouted full length using materials in 10 CSR 23-5.050(8).

(B) Vertical heat pump wells drilled two hundred feet (200') or less that are not grouted full-length must follow the hole size requirements stated in section (5) and non-slurry bentonite plugs must be placed in the borehole. A plug (first plug) must be placed forty feet (40') above the total depth of the borehole. This plug must be composed of bentonite chips or pellets utilizing at least one (1) bag of bentonite resulting in at least a five foot (5') plug. Every forty feet (40') of borehole that exists above the first plug must have a plug set as described in this section. A near surface plug, consisting of bentonite granules or powder, must be set from a point ten feet (10') below the bottom of the trench that connects the closed-loop to the heat pump machine to the base of the trench. All bentonite plugs must be hydrated immediately with six to eight (6-8) gallons of potable water for each bag of bentonite after emplacement if they are in the unsaturated zone. All clean fill material placed between the bentonite plugs must be chlorinated. Clean fill is defined as sand, local drill cuttings, pea gravel, varied sized agricultural lime, or clean aggregate free from contamination. Contractors utilizing this type of grouting method must notify the department at least forty-eight (48) hours prior to beginning any construction on the system. The department will maintain a list of current notification methods (includes, but is not limited to, telephone, fax, email, voice mail, and the department's online notification system) and contact information available online or upon request. Notification information must include: owner name, owner address, GPS location, date work is to begin, primary contractor name, primary contractor permit number, drilling contractor name, and drilling contractor permit number.

(8) Approved Grout Materials. The following four (4) grout types are permitted for use in heat pump wells:

(A) Bentonite Slurry. High solids sodium bentonite slurry must be at least twenty percent to thirty percent (20%-30%) by weight solids to be used as grout. Thickened drilling mud or thinner bentonite slurry is strictly prohibited. When bentonite slurry is used, it must be applied in one (1) continual motion, through a tremie lowered to the grouting point;

(B) Nonslurry Bentonite. Only chipped or pelletized bentonite may be used when sealing the annulus of a well that is below the water level in the saturated zone. All nonslurry sodium bentonite varieties may be used in the unsaturated zone if the hole is dry and no bridging occurs. The dry bentonite must be hydrated after emplacement;

(C) Thermal Grout Slurry. Grout containing at least seven and one-half percent (7.5%) by weight bentonite solids and no more than sixty-five percent (65%) by weight silica solids may be used as grout. Specialized pumps are required to pump thermal grout slurry through a tremie lowered to within twenty feet (20') of the base of the borehole; and

(D) Other Grout. Other types of grout may be used if advanced written approval is obtained by the department.

(9) Wells that Encounter Karst Conditions. When a borehole encounters caves or larger fractures, chlorinated clean fill, such as gravel or sand, may be used to fill these intervals. Small fractures are effectively sealed by using chipped, hydrated bentonite. If the borehole cannot be grouted as specified, it must be plugged.

(10) Jetted Heat Pump Wells. Closed-loop heat pump wells that are jetted in Drilling Area 5 (see Figure 5) must have a minimum top grout plug of ten feet (10').

(11) Heat Pump Wells in Drilling Area 12 (formerly Special Area 3) may be constructed provided advanced written approval is obtained from the department pursuant to 10 CSR 23-3.090(12).

(12) Heat Pump Wells in Drilling Area 13 (formerly Special Area 4) may be constructed provided advanced written approval is obtained from the department pursuant to 10 CSR 23-3.090(13).

*AUTHORITY: sections 256.606 and 256.626, RSMo 2016.\* Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995.*





*Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Dec. 16, 2002, effective June 30, 2003. Emergency amendment filed March 21, 2005, effective April 1, 2005, expired Sept. 27, 2005. Amended: Filed Sept. 27, 2005, effective April 30, 2006. Amended: Filed Jan. 4, 2007, effective Aug. 30, 2007. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

#### **10 CSR 23-5.060 Construction Standards for Open-Loop Heat Pump Systems**

**PURPOSE:** *This rule sets standards for open-loop heat pump systems that use wells to produce or return groundwater.*

(1) Open-loop groundwater supply wells shall be constructed to domestic/multifamily well standards pursuant to 10 CSR 23-3.030(1) if it produces less than seventy (70) gallons per minute and to high yield well standards pursuant to 10 CSR 23-3.030(3) if it produces more than seventy (70) gallons of water per minute. Any well that was constructed before October 1987 that is utilized as the water supply or return for an open-loop heat pump system is exempt from these rules, except that the surface disposal of the water may be subject to other regulations.

(2) Heat pump systems and surface disposal of used water may require a permit pursuant to 10 CSR 20-6.

(3) Open loop water return wells shall be constructed to domestic/multifamily well standards pursuant to 10 CSR 23-3.030(1) if it produces less than seventy (70) gallons per minute and to high yield well standards pursuant to 10 CSR 23-3.030(3) if it produces more than seventy (70) gallons of water per minute. The depth of the return well shall be a similar depth as the supply well and the water must be returned to the same aquifer. The water return pipe must extend at least twenty feet (20') below the static water level.

**AUTHORITY:** *sections 256.606 and 256.626, RSMo 2016.\* Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

#### **10 CSR 23-5.070 Closed-Loop Heat Pump Systems That Use Refrigerants as the Heat Transfer Fluid**

*(Rescinded December 30, 2018)*

**AUTHORITY:** *sections 256.606 and 256.626, RSMo 2000. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Rescinded: Filed April 25, 2018, effective Dec. 30, 2018.*

#### **10 CSR 23-5.080 Plugging of Heat Pump Wells**

**PURPOSE:** *This rule sets standards on the proper plugging of wells used in heat pump applications.*

(1) Vertical Closed-Loop Heat Pump Wells. To plug a properly constructed vertical closed-loop heat pump well the following specifications must be met:

(A) Remove all heat transfer fluid from the closed-loop and take necessary precautions to ensure groundwater protection; and

(B) Dig down to the top of borehole and cut off the loop pipe at least three feet (3') below the surface. Pump the remaining loop full of bentonite or cement slurry. Allow the grout to fill the upper one foot (1') of borehole. Fill remaining hole with compacted earth or pavement.

(2) Open-Loop Heat Pump Wells. Wells used to supply water for heat pump and water return wells must be plugged pursuant to 10 CSR 23-3.110.

**AUTHORITY:** *sections 256.606, 256.623, and 256.626, RSMo 2016.\* Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.623, RSMo 1985, amended 1991; and 256.626, RSMo 1985, amended 1991.*



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**Rules of**  
**Department of Natural Resources**  
**Division 23—Well Installation**  
**Chapter 6—Test Hole Construction Code**

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## Title 10—DEPARTMENT OF NATURAL RESOURCES

### Division 23—Well Installation Chapter 6—Test Hole Construction Code

#### 10 CSR 23-6.010 Definitions

(Rescinded February 28, 2019)

*AUTHORITY:* sections 256.606 and 256.626, RSMo Supp. 1991. Original rule filed Aug. 17, 1993, effective March 10, 1994. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

#### 10 CSR 23-6.020 General Protection of Groundwater Quality and Resources

*PURPOSE:* This rule protects the overall groundwater quality and resources in Missouri.

(1) All test holes shall be constructed in a manner that will conserve and protect the groundwater resources and not be a source or channel of contamination or pollution to any aquifer.

(2) Test holes may be converted into other types of wells provided advanced written approval is obtained from the department and the well is constructed to the minimum standards provided in 10 CSR 23.

*AUTHORITY:* sections 256.606, 256.615, and 256.626, RSMo 2016.\* Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.606, RSMo 1991; 256.615, RSMo 1991; and 256.626, RSMo 1985, amended 1991.

#### 10 CSR 23-6.030 Location of Test Holes

*PURPOSE:* This rule sets criteria for the location of test holes.

(1) Setback distances shall be followed pursuant to 10 CSR 23-3.010(1) Table 3.1.

*AUTHORITY:* sections 256.606 and 256.626, RSMo 2016.\* Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.

#### 10 CSR 23-6.040 Construction Standards for Test Holes

*PURPOSE:* This rule describes the minimum standards for a properly constructed test hole.

(1) Casing when used shall follow the minimum standards pursuant to 10 CSR 23-3.030(1)(A).

(2) Casing Depth. If permanent surface casing is set, it must be set at least thirty feet (30') into bedrock.

(3) Temporary Cap. All holes must be capped during the period they remain unplugged pursuant to 10 CSR 23-3.030(1)(E).

(4) Grout when used to seal casing annulus shall follow materials and methods pursuant to 10 CSR 23-3.030(1)(C).

*AUTHORITY:* sections 256.606 and 256.626, RSMo 2016.\* Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

\*Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.

#### 10 CSR 23-6.050 Plugging of Test Holes

*PURPOSE:* This rule establishes criteria for the proper procedures to be followed when plugging a test hole.

(1) All test holes, except those that are converted to other types of wells shall be plugged in accordance with this chapter within sixty days from the date that the well was drilled. Submit plugging registration records pursuant to section 256.614.1, RSMo. Test holes are exempt from submitting construction certification records.

(A) Plugging the Test Hole.

1. Test holes with no surface casing.

A. Fill the test hole from total depth to within two feet (2') of ground surface with grout.

B. If the Davis Formation is penetrated, a grout plug shall extend from the bottom of the formation to within two feet (2') of ground surface.

C. A mechanical packer may be installed at the bottom of the Davis Formation or emplace clean fill from total depth to the bottom of the Davis Formation to hold the grout plug in place.

D. Fill the top two feet (2') of hole

with soil.

2. Test holes with removable surface casing pipe.

A. Remove the surface casing and any interior casing if used.

B. Fill the test hole from total depth to within two feet (2') of ground surface with grout.

C. If the borehole has collapse potential, add grout as casing is withdrawn.

D. If the Davis Formation is penetrated, a grout plug shall extend from the bottom of the formation to within two feet (2') of ground surface.

E. A mechanical packer may be installed at the bottom of the Davis Formation or emplace clean fill from total depth to the bottom of the Davis Formation to hold the grout plug in place.

F. Fill the top two feet (2') of hole with soil.

3. Test holes with grouted nonremovable surface casing.

A. Cut the casing off two feet (2') below ground surface or three feet in an agricultural area. If bedrock is encountered, cut the casing flush with the top of bedrock.

B. Fill the test hole from total depth to within two feet (2') of ground surface with grout.

C. If the Davis Formation is penetrated, a grout plug shall extend from the bottom of the formation to within two feet (2') of ground surface.

D. A mechanical packer may be installed at the bottom of the Davis Formation or emplace clean fill from total depth to the bottom of the Davis Formation to hold the grout plug in place.

E. Fill the top two feet (2') of hole with soil.

(2) Test holes drilled to expand quarrying and surface mining operations.

(A) Test holes completely destroyed within one (1) year of the advance of the mine or quarry shall have a ten foot (10') surface grout plug and are exempt from plugging registration requirements.

(B) Test holes that are not destroyed within one (1) year of the advance of the mine or quarry are subject to plugging requirements pursuant to 10 CSR 23-6.050(1).

(C) Test holes that penetrate the quarry or mine floor which are not completely destroyed by the quarry or mine operation shall be plugged with grout from total depth to the bottom of the quarry or mine and are subject to plugging registration requirements.

(3) Clay mining operations. Test holes that do not penetrate beneath an impermeable fire



clay deposit shall have a ten foot (10') surface grout plug and are exempt from plugging registration requirements.

(4) Unconsolidated material test holes less than one hundred feet (<100') deep.

(A) Test holes less than twenty feet (<20') in depth may be plugged using clean fill or uncontaminated native material and are exempt from plugging registration requirements.

(B) One (1) registration report and fee is required per site for test holes that are twenty feet (20') in depth or greater. All test holes plugged may be reported on one (1) form.

(C) Test holes where no ground water is encountered, may be plugged using clean fill or uncontaminated native material.

(D) Test holes may not be used for monitoring.

*AUTHORITY* sections 256.606, 256.614, 256.615, and 256.626, RSMo 2016.\* *Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 256.606, RSMo 1991; 256.614, RSMo 1985, amended 1991; 256.615, RSMo 1991; and 256.626, RSMo 1985, amended 1991.*

**10 CSR 23-6.060 Confidentiality of Registration Report Form**  
(Rescinded February 28, 2019)

*AUTHORITY* sections 256.606, 256.614, 256.615 and 256.626, RSMo Supp. 1991. *Original rule filed Aug. 17, 1993, effective March 10, 1994. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.*



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**Rules of**  
**Department of Natural Resources**  
**Division 50—Oil and Gas Council**  
**Chapter 1—General Procedures and Definitions**

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**Title 10—DEPARTMENT OF  
NATURAL RESOURCES  
Division 50—Oil and Gas Council  
Chapter 1—General Procedures  
and Definitions**

**10 CSR 50-1.010 Organization**  
(Rescinded August 30, 2018)

*AUTHORITY: sections 259.010, 259.020, and 259.030, RSMo Supp. 2015, and section 259.040, RSMo Supp. 2013. Original rule filed Oct. 11, 1966, effective Oct. 22, 1966. Amended: Filed Sept. 12, 1973, effective Sept. 22, 1973. Amended: Filed June 14, 1976, effective Nov. 12, 1976. Amended: Filed Sept. 15, 2015, effective March 30, 2016. Rescinded: Filed Dec. 29, 2017, effective Aug. 30, 2018.*

**10 CSR 50-1.020 General Procedures**

*PURPOSE: This rule provides for the general practice and procedure of the council and the application of rules promulgated by the council.*

(1) All rules promulgated apply statewide unless otherwise specifically excepted by a written order of the council.

(2) The notice requirements in section 259.140, RSMo, apply to each hearing arising under Chapter 259, RSMo, and implementing regulations heard by the council or any agent appointed by the council.

(A) A copy of the notice of the hearing will be mailed by the council to each person who has filed for the purpose of receiving notice. The notice will be mailed not less than ten (10) business days prior to the hearing date.

(B) The council also will provide notice to any person whose property interests may be affected by the outcome of the hearing.

(3) The council, after a hearing as provided by law, may order an operation to cease or wells to be plugged upon a finding that any provisions of the laws, rules, or conditions of the council or state geologist have been violated or that any fraud, deceit, or misrepresentation was made to obtain the approval of a permit. Appeals of any decision of the council may be made as provided by law.

(4) Information submitted pursuant to Chapter 259, RSMo, and implementing regulations shall use Missouri nomenclature.

(5) Confidentiality. Information gathered pursuant to Chapter 259, RSMo, and implement-

ing regulations is public record pursuant to the Missouri Sunshine law, Chapter 610, RSMo. Confidentiality may be granted upon request, in accordance with section 640.155.1, RSMo. Cancelled permits are not considered confidential.

(A) If a written request for confidentiality is made to the state geologist within one hundred twenty (120) days of the spud date or the date of commencement of recompletion of the well, all information, samples, or cores filed per 10 CSR 50-2.050 will be held in confidential custody for an initial period of one (1) year from the written request.

(B) All rights to confidentiality shall be lost if the filings are not timely, as provided in 10 CSR 50-2.050, or if the request for confidentiality is not timely, as provided in subsection (5)(A).

(C) Samples, cores, or information may be released before the expiration of the one- (1-) year period only upon written approval of the operator.

(D) If a request for an extension is made at least thirty (30) days before the expiration of the initial one- (1-) year period, the period of confidentiality may be extended for one (1) additional year.

*AUTHORITY: sections 259.070, 259.140, 259.190, and 259.200, RSMo 2016.\* Original rule filed Oct. 11, 1966, effective Oct. 21, 1966. Amended: Filed Sept. 12, 1973, effective Sept. 22, 1973. Amended: Filed Sept. 13, 1983, effective Dec. 11, 1983. Amended: Filed Sept. 15, 2015, effective March 30, 2016. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

*\*Original authority: 259.070, RSMo 1965, amended 1972, 1983, 1987, 1993, 1995, 2012, 2015; 259.140, RSMo 1965; 259.190, RSMo 1965, amended 1983, 2015; and 259.200, RSMo 1965.*

**10 CSR 50-1.030 Definitions**

*PURPOSE: This rule provides the definitions for terms used in 10 CSR 50 that are not defined in section 259.050, RSMo.*

(1) The terms used in 10 CSR 50 have the meanings set forth in section 259.050, RSMo, or this rule, unless the context of the term clearly indicates otherwise.

(A) Terms beginning with the letter A.

1. Abandoned site, any property or lease that is no longer operated as an active site for oil and gas production and injection projects.

2. Abandoned well, a well that is no longer operated for its intended use and has not been shut in, converted to another type of well, or plugged.

3. Area of review, an area surrounding an injection well(s) that extends a minimum of one-half (1/2) mile from the well(s) or from the unit boundary of an enhanced recovery project.

4. Area of review well, any well including, but not limited to, water wells, abandoned wells, plugged wells, and dry holes, located within the area of review, which penetrates the injection interval.

(B) Terms beginning with the letter B.

1. (Reserved)

(C) Terms beginning with the letter C.

1. Casing, the impervious, durable, tubular materials used to line a wellbore.

2. Casinghead gas, gas produced that was in solution with oil in its original state in the reservoir.

3. Cement, portland cement or a blend of portland cement.

4. Coalbed natural gas, natural gas produced from either coal seams or associated shale.

5. Commercial well, a well from which oil or gas is recovered and sold, traded, or otherwise used for profit.

6. Common source of supply, synonymous with "pool" as defined in Chapter 259, RSMo.

7. Confining strata, geologic stratum or strata that serve as a barrier between water-, oil-, or gas-bearing strata.

8. Core, a continuous section of geologic materials recovered during drilling.

9. Corrective action, remedial action on any well to prevent the migration of fluids from the surface or from one (1) stratum to another.

10. Correlative rights, the right of each owner or operator in a pool to obtain that owner's or operator's just and equitable share of the oil or gas resource, or an economic equivalent of that share of the resource, produced in a manner or amount that will not have any of the following effects:

A. Damage the reservoir;

B. Take an undue proportion of the obtainable oil or gas; or

C. Cause undue drainage between developed leases.

11. Council, the State Oil and Gas Council established by section 259.010, RSMo.

(D) Terms beginning with the letter D.

1. (Reserved)

(E) Terms beginning with the letter E.

1. Enhanced recovery, any process used to increase the recovery of oil or gas from a pool through secondary or tertiary recovery. Enhanced recovery includes, but is not limited to, water floods, pressure maintenance projects, cycling or recycling projects, steam